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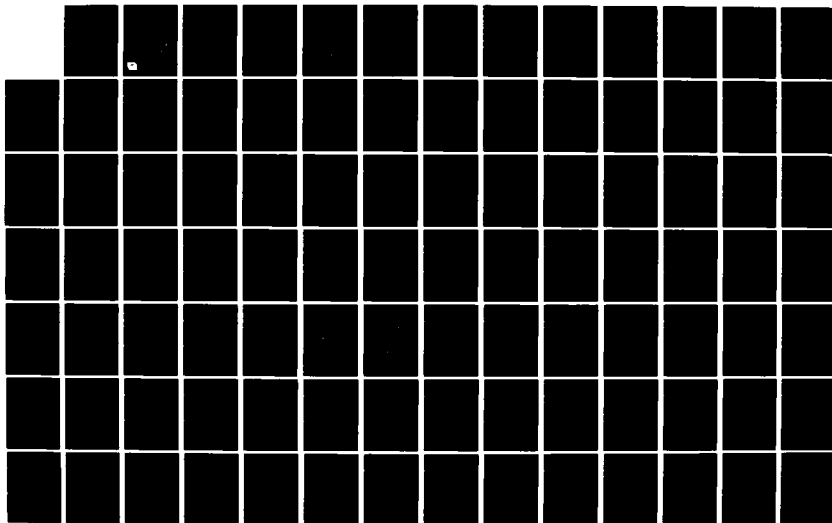
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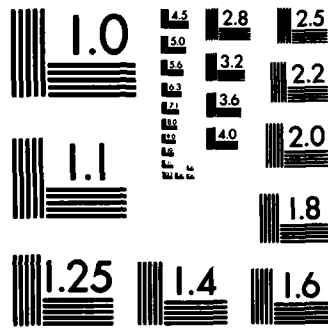
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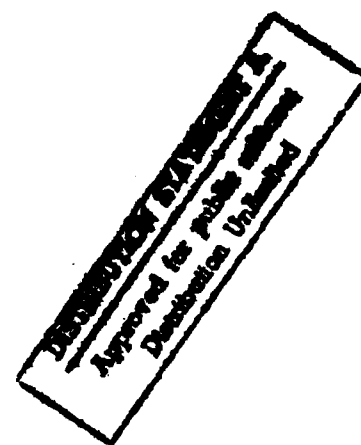
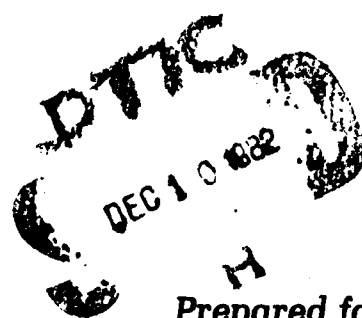


IDA STUDY S-538

**THE REINSTITUTION OF THE CONSTRUCTION OF
U.S. NAVY COMBATANT SHIPS IN
U.S. GOVERNMENT OWNED SHIPYARDS (U)**

John N. Fry
John D. Wells

January 1982



Prepared for
Office of the Under Secretary of Defense for Research and Engineering



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INSTITUTE FOR DEFENSE ANALYSES
PROGRAM ANALYSIS DIVISION

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) (U) This study considers the question of re-instituting ship construction in Government-owned shipyards in the context of the proposed expansion of the U.S. Fleet embodied in PDM 83. Emphasis is given to the capability to build nuclear combat ships.		

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**John N. Fry
John D. Wells**

January 1982



**INSTITUTE FOR DEFENSE ANALYSES
PROGRAM ANALYSIS DIVISION
1801 N. Beauregard Street
Alexandria, Virginia 22311**

**Contract MDA 903 79 C 0018
Task T-1-112**

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PREFACE (U)

(U) This study was prepared by the Institute for Defense Analyses (IDA) for the Office of the Under Secretary of Defense, Research and Engineering, Naval Warfare (OUSDRE/NW) under Contract No. MDA 903 79 C 0018, Task Order No. T-1-112, dated 12 June 1981. This publication is issued in fulfillment of the contract.

(U) The objective of this study was to provide the Secretary of Defense with sufficient information on which to base his recommendation to the President as to the construction of U.S. Navy vessels in government yards, as required by the Vinson-Trammell Act.

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(U) The authors wish to acknowledge the kind assistance of the Naval Sea Systems Command, particularly NAVSEA 07Z, in obtaining much of the planning data used in the analysis. Since such planning information is under continuous revision, some figures may not correspond to what is available after publication. However, we feel the study findings do not turn upon small changes in the data. Nevertheless, any discrepancies remain the authors' responsibility, as do important interpretations of the data. In addition, crucial review and guidance as to matters of fact and sources of information were provided by an Executive Review Panel of OPNAV and NAVSEA personnel chaired by John McGough of USDRE. The authors are indebted to RADM J.W. Lisanby and other members of the Panel, who, of course, cannot be held responsible for any conclusions or recommendations.

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EXECUTIVE SUMMARY (U)

A. STUDY OBJECTIVE (U)

(U) This study was performed by the Institute for Defense Analyses (IDA) for the Office of the Under Secretary of Defense Research and Engineering (Naval Warfare) (OUSDRE/NW). The objective was to provide information for the Secretary of Defense's recommendation on the division of FY 1983 naval shipbuilding assignments between private and government shipyards as required by the Vinson-Trammell Act of 1934. This Act specifies that the lead ship of each new class of warships and every other succeeding ship be built in a government shipyard. The President may choose to vary this pattern in any year if he finds it to be in the national interest. In each year since 1966 the choice has been to assign all ships to privately owned shipyards.

B. BACKGROUND (U)

(U) The Vinson-Trammell recommendation for FY 1983 was judged to require more serious consideration than in the past several years as to the possibility of reinstituting active new construction shipbuilding in one or more government yards. Among the reasons for such serious consideration was the continued decline of the U.S. shipbuilding industry in face of an approval of major increases in the future fleet size. Particular concern has been expressed about the U.S. capability to construct nuclear surface ships and submarines because of the difficulties in recent years with the two shipyards capable of nuclear building, Newport News Shipbuilding and Electric Boat. These difficulties have

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involved substantial claims for payment over contract amounts and late deliveries of contracted ships. Preliminary study efforts established that the capacity of government and private shipyards to overhaul and repair nuclear ships also must be considered along with new construction. Figure S-1 summarizes the combined building and overhaul demand on capacity as determined from Navy assignments of future projects. Figure S-2 shows the yards and their locations.

C. INFORMATION-GATHERING PROCEDURES (U)

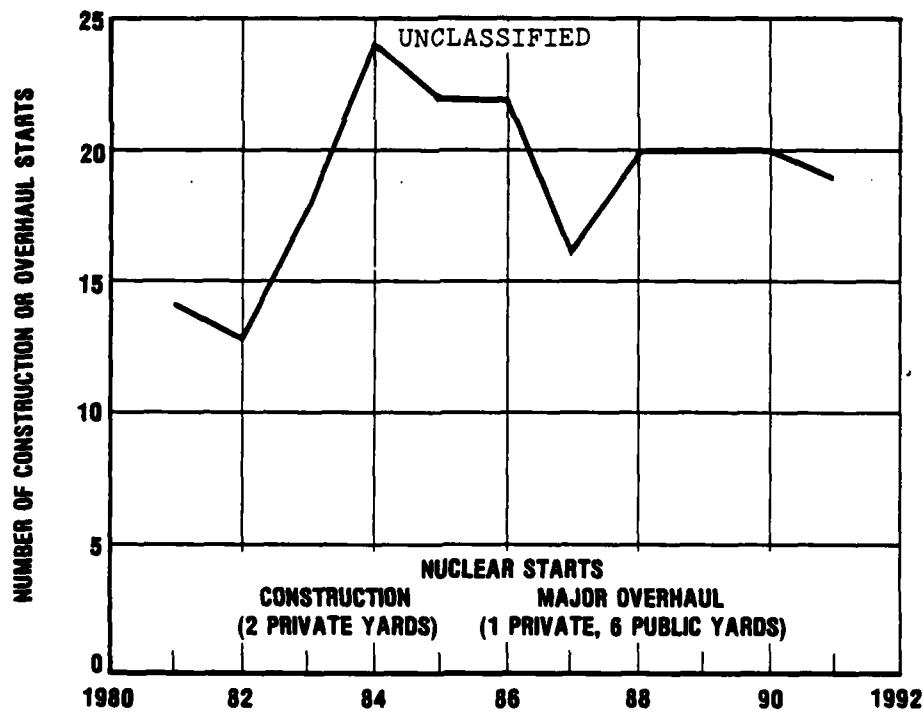
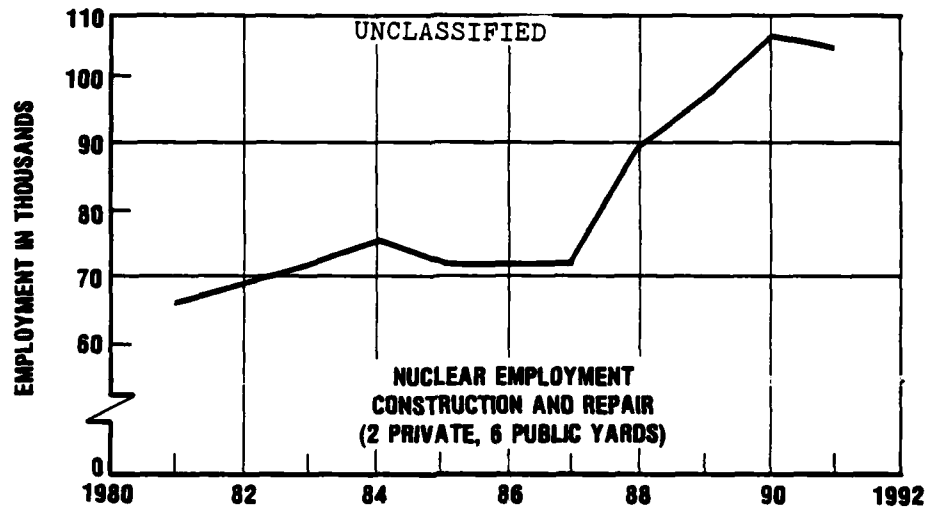
(U) The basic information used in the analysis was obtained by:

1. (U) Examining pertinent published documents developed during the period when the government shipyards were actively engaged in ship construction
2. (U) Analyzing recent proposals of government shipyards with respect to their capability and requirements if they were assigned nuclear surface and/or submarine construction
3. (U) Visiting the three government shipyards considered by the Navy for new ship construction assignments and two private shipyards to discuss their capacities, technical capabilities and requirements and to inspect the physical facilities
4. (U) Consulting with knowledgeable military and civilian personnel in NAVSEA as well as with the Executive Review Panel on various questions of planning, scheduling, management and data interpretation.
5. (U) Examining wage and manpower information. Wage data on private shipyards was provided by the Shipbuilders Council of America. Government shipyard wage data, manyear costs and productivity information came from DoD and NAVSEA sources and from special studies provided by the Puget Sound, Portsmouth and Mare Island Naval Shipyard commanders.

(U) The visits to the shipyards were especially helpful. Key personnel at each shipyard thoroughly briefed

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NUCLEAR SHIPBUILDING INDUSTRY LOADING



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Figure S-1. (U) NUCLEAR SHIPBUILDING INDUSTRY LOADING

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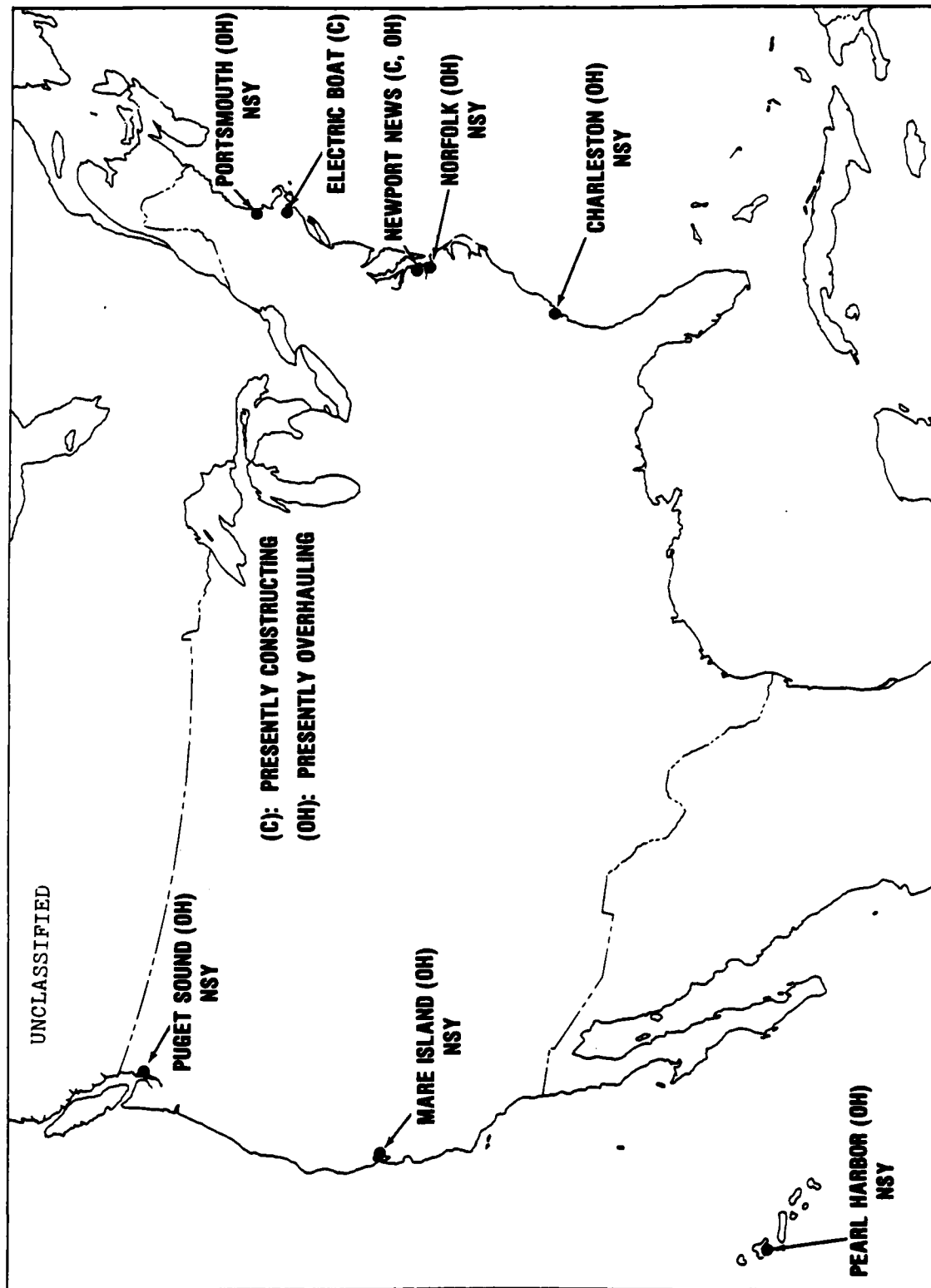


Figure S-2. (U) LOCATION OF NUCLEAR SHIPYARDS

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the study team as to yard capacities, capabilities, and requirements and were quite candid during the ensuing discussions. All shipyard representatives freely responded to questions and provided whatever information the study team requested.

(U) Because the government shipyards have not constructed Naval ships for nearly ten years, it was not possible to obtain current construction cost figures. The analysis of government versus private shipyard relative costs, therefore, was restricted to an examination of past relationships and an assessment as to whether or not these same relationships would exist in the future. Current relative wage rates as well as relative overhaul and repair manday rates were used as proxies for relative construction costs.

D. THE QUESTIONS TO BE ANSWERED (U)

(U) Restating the purpose of the study in the form of questions which the following chapters seek to illuminate, we obtain the following.

1. (U) Is a new construction capacity needed in government shipyards either for use in the timely completion of the planned Navy shipbuilding program or as a reserve against contingencies?
2. (U) What are the relative costs and construction alternatives if active new construction in government shipyards were required?
3. (U) If a reserve construction capacity in government yards is a current requirement, is an active construction program necessary to maintain it in viable condition?

E. STUDY ASSUMPTIONS (U)

(U) The following assumptions have been made throughout the study:

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1. (U) The naval shipbuilding rates of production will be as stated in the fiscal year 1983 Program Decision Memorandum (PDM-83) and the Extended Planning Annex (EPA).
2. (U) The volume of overhaul and repair of nuclear-powered warships which affects government and private shipyards currently considered for nuclear ship construction will continue at the levels projected by the Navy. Figure S-1 (see page S-3) summarizes combined construction and overhaul and repair projections.
3. (U) A recent IDA study¹ has shown that private sector shipbuilders have sufficient unused capacity and the technical capability to produce all non-nuclear naval surface ships required by the PDM-83/EPA as well as to perform assigned overhaul and repair of non-nuclear naval ships. Therefore the study has been limited to a consideration of nuclear naval ship construction².
4. (U) The shipyards that currently have the technical capability and special qualifications for nuclear ship construction are listed below.

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Private Shipyards			Government Shipyards		
Nuclear Ship Type	Newport News	Electric Boat	Puget Sound	Mare Island	Portsmouth
<u>Submarines</u>					
Trident	yes*	yes	yes*	No	No
SSN-688	yes	yes	yes*	yes	yes
<u>Surface Ships</u>					
CVN	yes	No	yes*	No	No
CGN-42	yes	No	yes*	yes*	yes*

* (U) Assumed capability. Has not actually constructed ships of this type.

¹ (U) Robert E. Kuenne, et.al., The Shipbuilding Industries of the U.S. and the U.S.S.R. as Bases for National Maritime Policies: Current Capabilities and Surge Demand Potential, Volume I: Main Report (U), (Institute for Defense Analyses Report R-260, February 1981), UNCLASSIFIED.

² (U) Philadelphia and Long Beach Shipyards, respectively, have already been assigned the carrier (SLEP) and battleship conversion programs.

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F. STUDY CONCLUSIONS AND RECOMMENDATIONS (U)

1. General Conclusions (U)

(U) The study concludes that

- a. (U) With regard to nuclear powered ships, Newport News Shipbuilding and Electric Boat appear to have sufficient capacity to complete all the scheduled
 - (U) Trident ballistic missile submarines
 - (U) SSN-688 class nuclear attack submarines
 - (U) Nuclear aircraft carriers
 - (U) Ballistic missile and other nuclear submarine overhauls not currently scheduled for government shipyards.
- b. (U) However, Newport News would not appear to have enough additional capacity to convert the CGN-38 cruisers and build the CGN-42-class nuclear cruisers as they are now scheduled in the PDM/EPA.
- c. (U) If some nuclear ships were assigned to the two West Coast government-owned shipyards, manpower ceilings would have to be raised. Assuming the productivity of the government yards would be equivalent to that of the two East Coast private yards, labor costs at the government yards would still be 19 to 35 percent higher than at the private yards.
- d. (U) Projected nuclear overhaul and repair assignments for government-owned shipyards may require increased manpower ceilings in the 1984-86 period and beyond.
- e. (U) If required in the national interest, a surge capacity for the construction of nuclear ships will not be available or feasible in the private sector during the PDM-83/EPA period. This implies that government shipyards will have to maintain such a capacity. Whether or not this would require an active construction program in government yards is an issue that requires a technical analysis beyond the scope of this study.

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G. SUMMARY OF SUPPORTING EVIDENCE FOR CONCLUSIONS (U)

1. There is Adequate Non-Nuclear Capacity (U)

(U) This conclusion is based on the results of IDA Study R-260,¹ as well as alternate building programs evaluated using the IDASAS computer model of shipbuilding capacity.

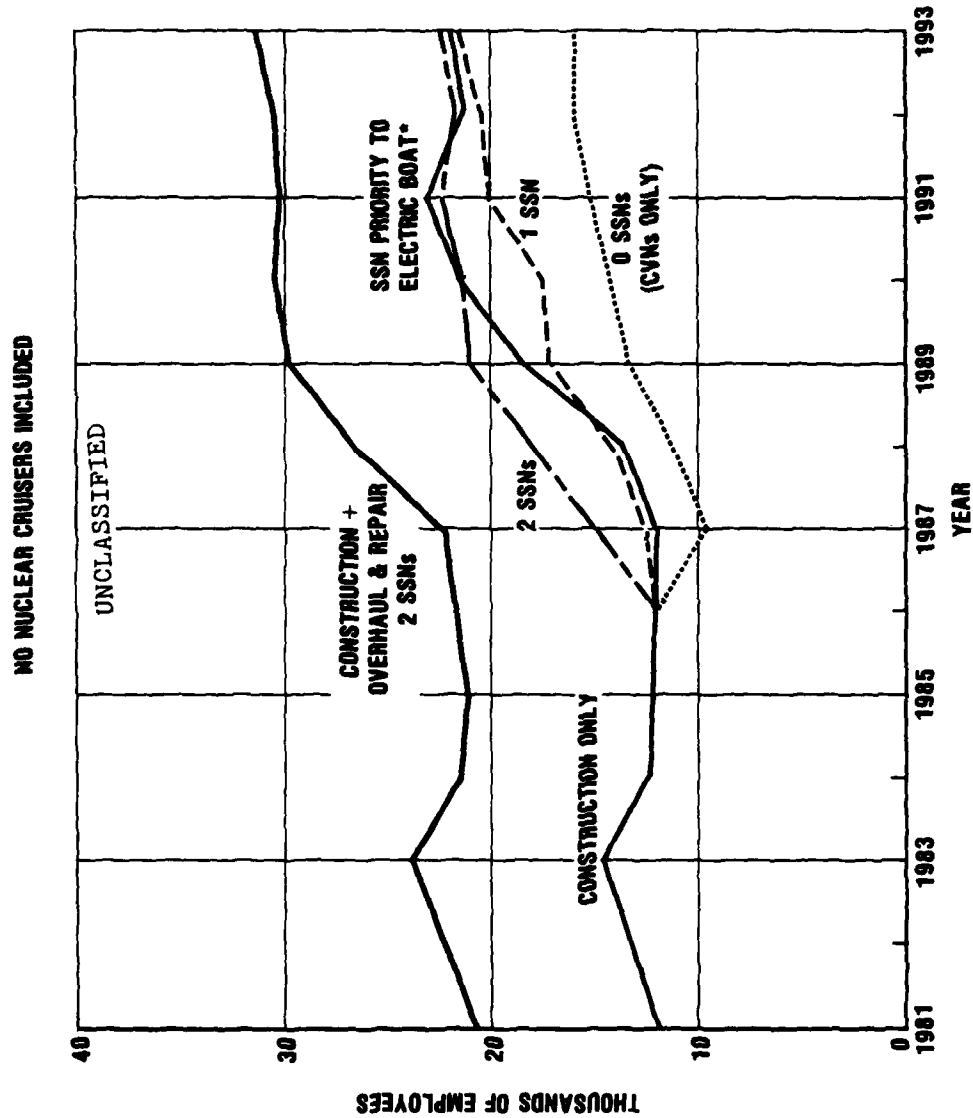
2. There is Adequate Nuclear Capacity at Electric Boat and Newport News for Trident, SSN-688 and CVN Programs (U)

(U) A computerized ship allocation model developed by IDA permitted evaluation of the physical capacities and manpower requirements at the two yards for alternative shipbuilding programs. The program uses as inputs the Navy planning factors for labor manday manloading curves, overhead factors, shipbuilding times and available building positions which were effective in July 1981. The program allocates the ships to the yards and generates time series of total employment at each yard. Figures S-3 and S-4 summarize the analysis.

(U) The necessary docks and ways, the materials handling facilities and processing shops at the two yards are adequate to build the nuclear submarines and surface ships scheduled within the planned construction times. This is not disputed by the Navy. However, there is doubt as to the ability of the private companies to hire, train and utilize the numbers of workers required to construct the ships at the planned rates. On the basis of discussions with company officials, a total employment of 30,000 was selected as a provisional maximum which could be effectively employed at the facilities (including off-site) of each of the two producers. A labor

¹(U)Robert E. Kuenne, et. al, The Shipbuilding Industries of the U.S. and U.S.S.R. as Bases for National Maritime Policies... (Institute for Defense Analyses Report R-260, February 1981), SECRET.

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*EB assigned as many SSN-688s as its physical capacity will handle (including the TRIDENT program).

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Figure S-3. (U) TOTAL EMPLOYMENT LEVELS AT NEWPORT NEWS UNDER ALTERNATIVE SSN ASSIGNMENTS

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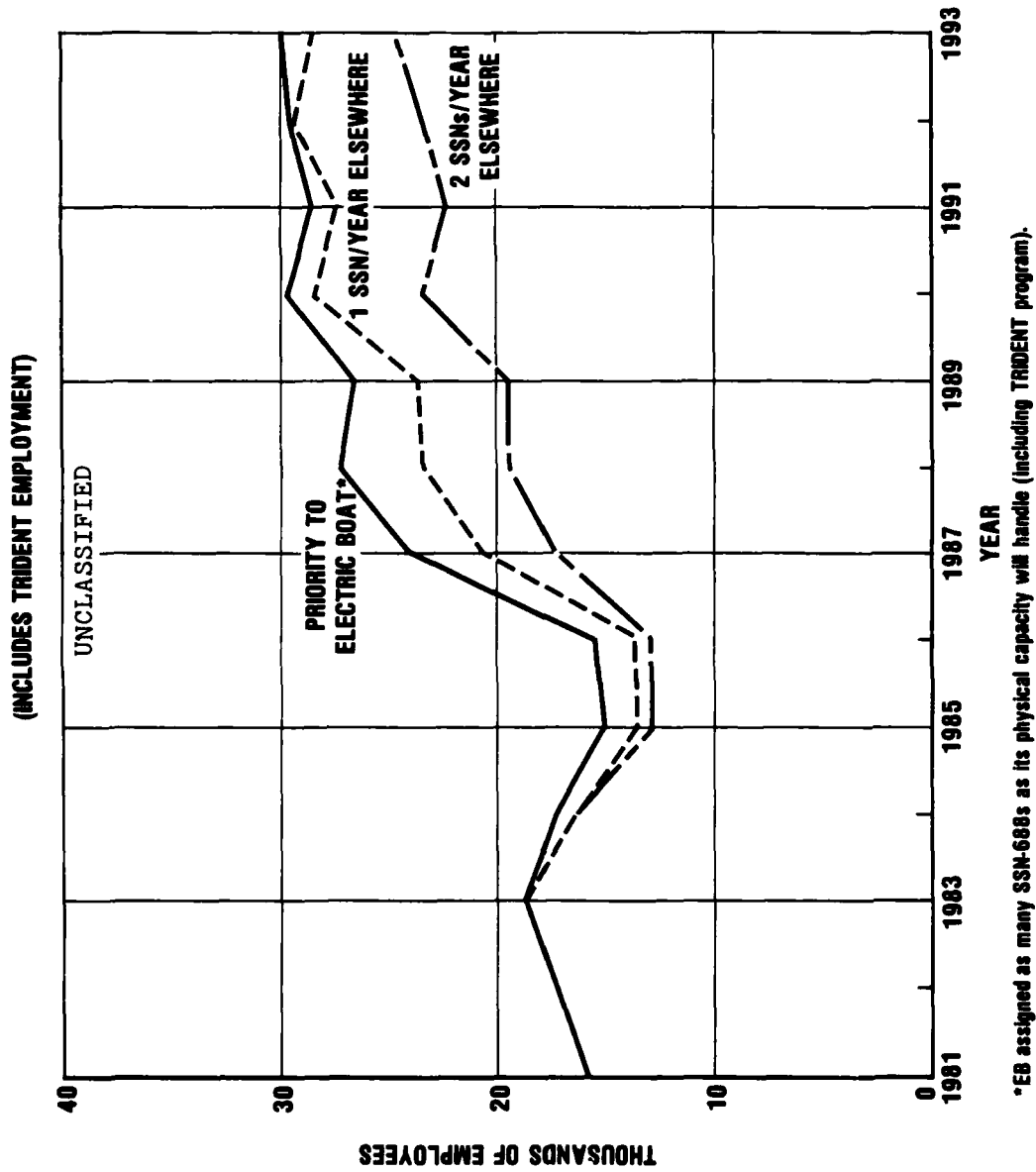


Figure S-4. (U) TOTAL EMPLOYMENT LEVELS AT ELECTRIC BOAT UNDER ALTERNATIVE SSN-688 ASSIGNMENTS

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force annual build-up of up to 2,000 was judged to be the highest that either company could expect to achieve. The IDASAS program generated results for various allocations of planned Tridents, SSN-688s and CVNs as shown in Figures S-3 and S-4. Total employment can be seen to only slightly exceed the 30,000 figure in the Newport News case and remain below for Electric Boat. However, build-up rates well above 2,000 per year are indicated in 1987-1989 for Newport News and 1986-1988 for Electric Boat. Since the planned building program for CVNs, Tridents and SSN-688s seems solidly assured, the study team believes that it is prudent to accept the private companies' argument that proper multi-year scheduling of work would smooth out the labor build-up.

(U) The Navy ship acquisition and overhaul and repair authorities disagree with the study team's assessment. They point to the past experience as well as current conditions in both shipyards (see pp. 19-22 of the main report). It is the Navy's conclusion that overhaul and repair requirements at both Newport and Electric Boat, Groton, could jeopardize the SSN-688 program. Although the estimated short-fall would be about one-third SSN per year, the Navy recommends a one-SSN per year building rate at one of the three nuclear qualified government shipyards with a construction mission. This rate is necessary to achieve production efficiency.

(U) The two private shipbuilders argue that the recent delivery problems are behind them. They cite new shipbuilding techniques which can increase productivity by as much as 25 percent. They claim to have no problems deriving from employment levels of 30,000 or more, because they have the option of using off-site facilities for many of the construction operations.

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(U) The study team has taken the position, on balance, that the two private shipbuilders can meet the PDM-83/EPA requirements for Tridents, SSN-688s and CVNs. However, as discussed below, there is some doubt that Newport News could also produce the nuclear cruiser and conversion programs as scheduled in the PDM-38/EPA. Moreover, there appears to be little or no excess nuclear shipbuilding capacity in the two private yards. Any surge in nuclear shipbuilding would have to be handled elsewhere, e.g. at government shipyards.

3. Overcapacity Would Result With Nuclear Cruisers (U)

(U) Adding the CGN-42 and CGN-38 programs to Newport News yields estimated loadings as shown in Figure S-5. Note that shifts of submarines away from Newport News would still leave an employment peak significantly over the 30,000 maximum and a build-up rate in excess of 7,000 per year. Eliminating scheduled nuclear overhaul and repair along with the SSNs would put the employment peak near the tolerable limit, but not solve the build-up rate problem. The critical years are 1987-90. Based on these results the scheduling of the nuclear cruiser awards in the PDM-83/EPA would appear unrealistic.

4. There Are Indications of Higher Production Costs at Government Shipyards (U)

(U) Since government shipyards are not currently building ships, the question of relative costs cannot be answered with finality. However, the principal elements of shipyard cost-- wage rates--are 19 to 35 percent higher in West Coast than in East Coast shipyards. Two of the three potential new building government yards are on the West Coast (Figure S-6 illustrates the comparison). Higher labor costs could be offset by higher productivity in government yards. However, recent Navy

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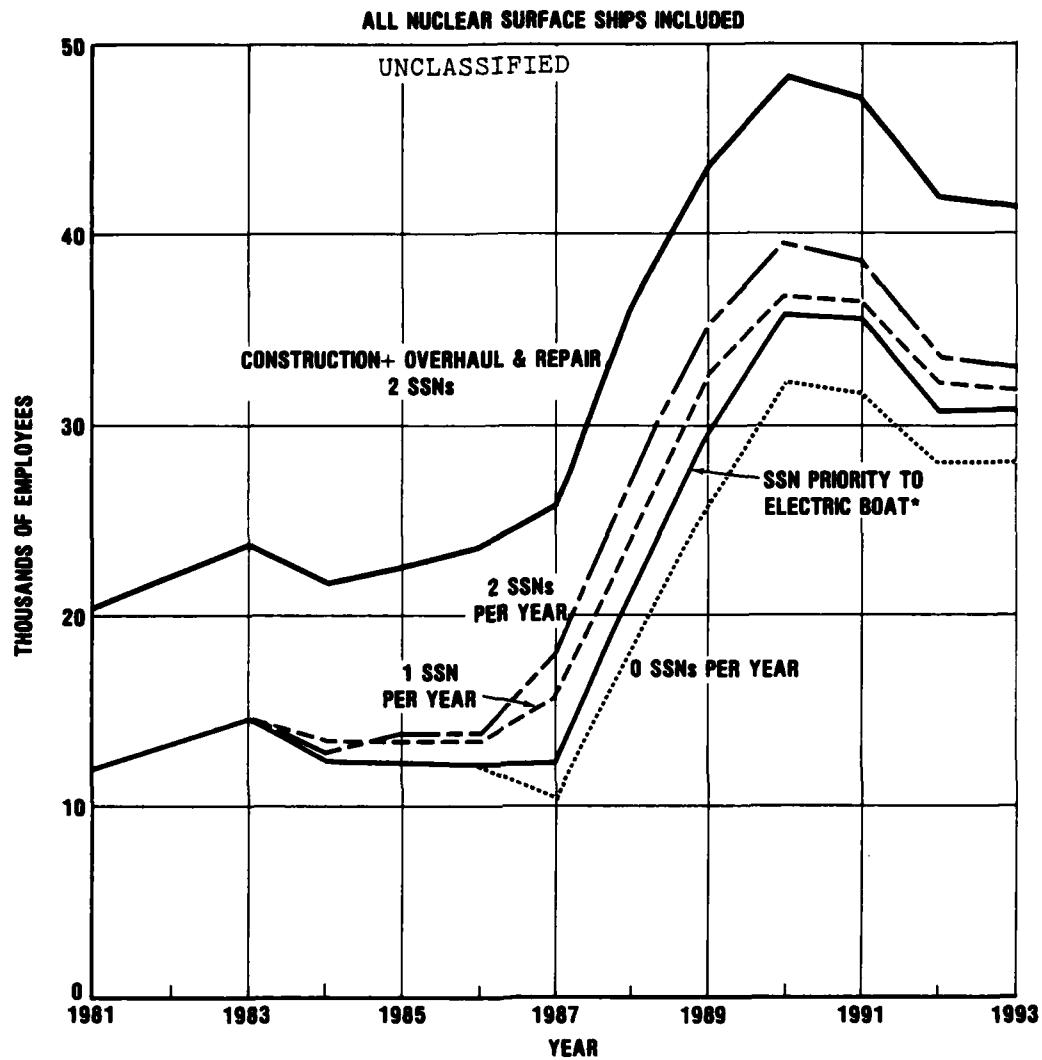
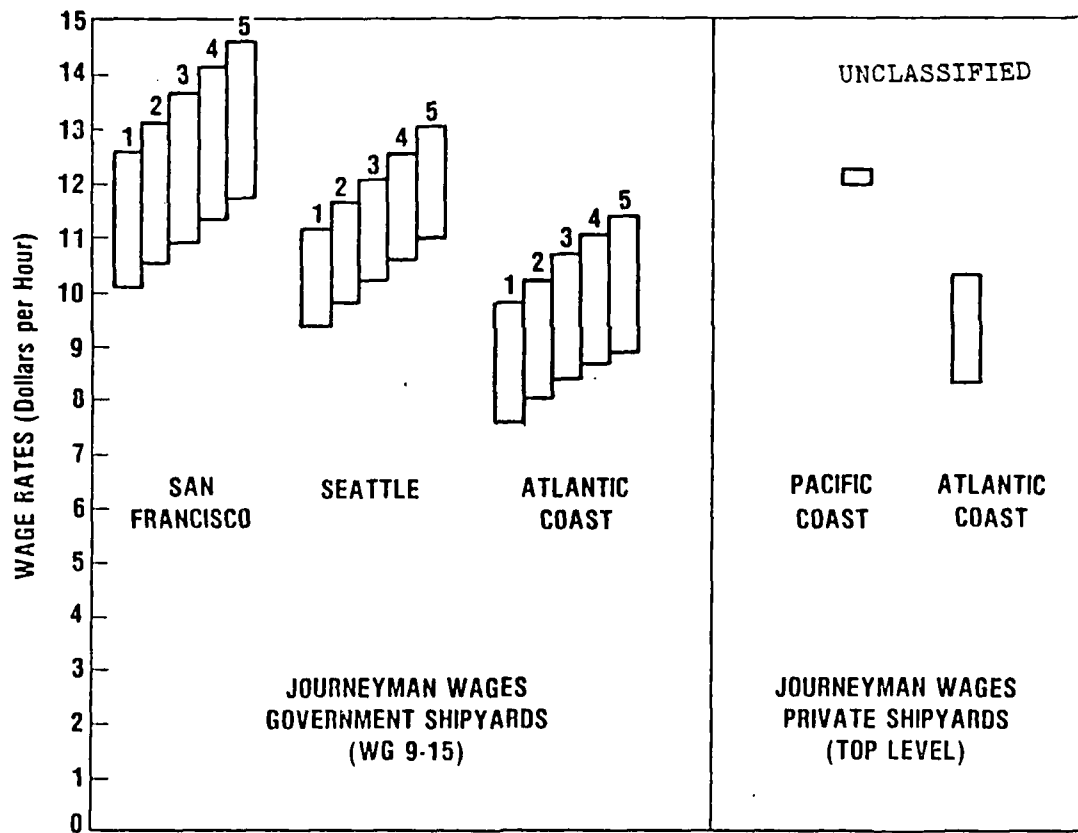


Figure S-5. (U) TOTAL EMPLOYMENT LEVELS AT NEWPORT NEWS UNDER ALTERNATIVE SSN-688 ASSIGNMENTS

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Source: (U) Department of Defense Wage Fixing Authority and Shipbuilders Council of America.

Figure S-6. (U) CURRENT JOURNEYMAN WAGE RATES IN GOVERNMENT AND PRIVATE SHIPYARDS

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estimates of manpower requirements for SSN-688 projects, as shown in Table S-1, would indicate that surpassing Newport News levels would be difficult.

5. There Will be a Nuclear Overhaul and Repair Overload (U)

(U) The six government shipyards now doing nuclear overhaul and repair are currently operating at or near manpower ceilings. Table S-2 shows the expected growth in nuclear repair and overhaul employment for these yards. These figures assume that current experience is valid for the older submarine overhauls and are therefore conservative. Employment ceiling relief for nuclear repair and overhaul seems clearly needed by FY 1984, unless other government shipyard tasks are to be slighted.

6. An Effective Nuclear Shipbuilding Surge Capability May Require Active Construction in Government Yards (U)

(U) If it is desirable as a matter of national policy to have some capacity to expand nuclear warship production beyond currently planned levels, an active construction program in government shipyards may be necessary for several reasons.

(U) First, the two private shipyards currently qualified to construct nuclear ships will be operating at virtually full capacity for the foreseeable future.

(U) Second, the development of a surge capability in the private sector, i.e., in new or previously (nuclear) qualified private shipyards, suffers from two disadvantages:

- (a) (U) Private sector producers would be unlikely to maintain unused capacity without some form of direct government subsidy.

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Table S-1. (U) PROJECTED SSN-688 DIRECT LABOR PRODUCTION
MANDAYS--GOVERNMENT VERSUS PRIVATE SHIPYARDS

UNCLASSIFIED				
Shipyard	Production Mandays (000)			
	Government Yard		Private Yard	
	First Ship	4th Ship	Attained	Projected
Puget Sound	900	670		
Mare Island	962	670-700		
Portsmouth	1,200	N.A.		
Electric Boat			699	825*
Newport News			526	624*

Sources: (U) U.S. Navy Shipyard Reports, NAVSEA Sources.

*(U) Most recent attained figures which are being used by NAVSEA for projections. Previous figures showed a projected reduction in mandays, reflecting learning. The current figures project the expected result of recent delays and slippage in the program.

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Table S-2. (U) NUCLEAR REPAIR AND OVERHAUL EMPLOYMENT PROJECTIONS--NEWPORT NEWS AND U.S. NAVY SHIPYARDS^a

UNCLASSIFIED		
	Employment in Thousands	
	<u>U.S. Navy Shipyards</u> Nuclear Repair	<u>Newport News</u> Nuclear Repair
1981	31.4	6.2
1982	33.7	8.4
1983	31.5	9.3
1984	37.3	8.7
1985	37.0	8.9
1986	36.0	9.8
1987	33.0	7.4
1988	34.3 ^b	8.4
1989	34.3	8.4
1990	34.3	8.4
1991	34.3	8.4

^a(U) Source: NAVSEA estimates.

^b(U) Seven-year average extended to 1991.

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- (b) (U) It is difficult to obtain public acceptance of additional nuclear construction sites on a contingency basis.

(U) The government shipyards qualified for nuclear ship construction are already in existence and have been accepted by the public. They are, and will be, heavily engaged in nuclear ship overhaul and repair and have potential alternative uses for the additional building capacity needed for the surge contingency.

(U) However, a fundamental issue which could not be examined in sufficient detail in this study still remains. This is the question as to whether or not a surge capability can be maintained in government shipyards without an active construction program. The Navy appears to be strongly in favor of an active program. However, the study team has not been convinced that an active program with its accompanying added costs is necessary. The resolution of the issue requires complex technical analyses beyond the scope of this study.

H. DECISION ALTERNATIVES (U)

(U) The following general alternatives for the choice required by the Vinson-Trammell Act in FY 1983 were identified:

1. Do not reinstitute new building in any government yard in FY 1983, but retain the shipbuilding mission (U), either
 - (a) (U) with no action except possible manpower ceiling increases, or
 - (b) (U) with major modernization of repair facilities at one or more yards.

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Discussion: (U) The consequences of choosing 1.(a) are that the Navy accept the current contract situation for new nuclear ships and a continued decline in its own stand-by capability to build ships. Given present (PDM-83) nuclear shipbuilding plans, no production schedule problem is likely before 1987 or later. Currently estimated two year lead times for a government yard to actually begin active building might become longer.

If 1.(b) were chosen and a ship lift and transfer system installed at one or more government yards, repair and overhaul capability would be improved¹ and such a facility could be used to assemble nuclear submarines from modules supplied by Newport News or Electric Boat. With these facilities in place, the response to a new building go-ahead thus could be reduced to months. An investment of \$89 million or more in Military Construction appropriations (MILCON) would be required in 1983-84.

2. Assign one or more FY 1983 (or later) awards to a government yard (U). The yard could either

- (a) (U) serve as a third source of SSN-688-class submarines, with the modernization of facilities to match that of Electric Boat and Newport News building technology desirable, or
- (b) (U) serve as design yard for the CGN-42-class cruiser and build the lead ship.

Discussion: (U) Choice of the 2.(a) alternative would require the Navy to develop some sort of subcontractor or

¹(U)Current Navy practice prohibits the lift of ships with fully fueled reactors on the grounds that flooding of a malfunctioning system is not possible as in a below-grade drydock. Some naval officers interviewed believed this policy might change in future.

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customer relationship with Electric Boat and/or Newport News. Unless additional submarines over these Navy-planned submarines were ordered, the result might be unused delivery capacity at Electric Boat, Groton or its return to overhaul and repair work. Besides the investment in MILCON as in 1.(b) above, higher construction costs for government built submarines would be likely.

(U) The 2.(b) alternative could be accomplished currently only at Puget Naval Shipyard. No major facilities modernization would be required. Diversion of facilities and manpower from repair and overhaul of nuclear surface ships would affect Pacific fleet readiness adversely until additional large-hull facilities were built on the West Coast.

3. Discontinue the new construction mission for government yards (U), while

- (a) (U) initiating development of additional private nuclear building capacity at currently qualified or to-be-qualified private yards, and
- (b) (U) taking action to increase nuclear overhaul and repair capacity at government yards by increased manpower and/or modernized facilities.

Discussion: (U) This option might require repeal of the operative Vinson-Trammell Act clauses. The development of additional private capacity would be needed only if the CGN-42 program were absolutely fixed in numbers and schedule or if a "warm" nuclear shipbuilding reserve base were desired. In either of these cases, the short-run effect might be to push additional nuclear overhauls into government shipyards.

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I. RECOMMENDATIONS (U)

(U) Whether or not the findings in this study point to a decision to resume new construction in government shipyards will depend upon the weighting of the various factors outlined above. The findings appear to support the following recommended actions, but there could be overriding considerations leading in other directions.

1. Sole Sources for CVNs and Tridents (U)

(U) The Government should concede that Newport News and Electric Boat are in fact the sole source suppliers of the CVNs and Tridents, respectively, and proceed to remove any uncertainties with respect to future (authorized) orders.¹

(U) This will help the shipyards to:

- a. (U) Maintain critical manpower levels,
- b. (U) Plan manpower acquisitions,
- c. (U) Plan and acquire materials and equipment, and, therefore
- d. (U) Improve production methods.

(U) Both shipyards have the potential for increasing productivity through prefabricating and prepackaging large modules and/or cylinders. This requires a high degree of advanced planning and acquisition of materials and equipment. Uncertainties as to whether or not the planned series of ships will actually be procured can seriously disrupt the process and, therefore, reduce productivity and increase costs.

¹(U) This does not mean that the Government should give up its prerogative of discontinuing orders if the shipyards' costs are prohibitive or if the yards' performance is unsatisfactory.

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2. SSN Programs (U)

(U) The government should recognize the fact that the combined capacity of Electric Boat (Groton and Quonset Point) and Newport News is adequate to meet the projected requirements for nuclear attack submarines. The PDM-83/EPA Trident and CVN programs, respectively, will not fully utilize the shipyards' productive capacities. The government should

- a. (U) Design a nuclear attack submarine procurement program that will take full advantage of the productive capacities of the two shipyards.
- b. (U) Recognize that such a decision would help stabilize manpower and materials acquisition at the two yards.

(U) The implementation of Recommendations 1 and 2 would settle the government's procurement policies with respect to its most certain and highest priority nuclear ship construction programs. To assure success of these programs, it is essential that business relations between the government and the two suppliers be such that they do not inhibit efficient ship construction. The assurance of a stable order book (subject, of course, to adequate supplier performance) would be a step in that direction. Given these stable market conditions, the suppliers would have an opportunity to substantiate their claims that the ships can be produced on schedule and with successively increasing efficiency.

(U) We recognize that the government has had difficulties with both Electric Boat and Newport News in recent years. However, the shipyards have made efforts to change the prevailing conditions. Electric Boat's Quonset Point Facility has met its commitments and will soon be under-utilized. Newport News made available its massive prefabrication facility and 1,600 foot graving dock for exclusive Navy ship construction and has made substantial additional

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improvements. These developments would appear to reduce the level of risk to the government in continuing to depend on the two suppliers.

3. CGN-42 Program (U)

(U) If the CGN-42 program is assured of funding through at least the lead ship, consideration should be given to constructing that lead ship at Puget Sound. Follow ships can be divided between Puget Sound and Newport News. The latter might be considered only if the shipyard is performing satisfactorily with respect to its CVN and SSN-688 assignments.

(U) If Recommendations 1 and 2 are implemented, Newport News will have responsibility of producing the CVNs and some of the attack submarines. Although the shipyard would have adequate physical facilities, there is some doubt as to whether it could develop the labor force to handle the entire CGN program.

(U) Puget Sound already has adequate construction-oriented facilities to build the CGNs. In addition, there are substantive benefits to reinforcing and maintaining a ship design, R&D, and construction capability within the Navy. Moreover, the shipyard has a demonstrated record of high productivity in previous shipbuilding efforts.

(U) However, a careful study should be made as to Puget Sound's future nuclear surface ship overhaul and repair workload, particularly for CVNs. If the CGN construction program would interfere with the overhaul and repair workload, the responsibility for CGN design and production might better be shifted to Newport News or to a third private company;

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however no other yard is currently licensed to undertake nuclear construction.¹

4. Naval Shipyards Repair and Overhaul Program (U)

(U) The Navy should study how its performance of more nuclear surface and submarine repair at its own shipyards could be reorganized and modernized to provide a quick-response conversion to construction if needed. The Navy would need additional resources to perform this work, i.e.,

- a. (U) Shipyard manpower ceilings should be raised where and when necessary,
- b. (U) Facilities improvement should be made where necessary,
- c. (U) Major reassignments of nuclear and non-nuclear work among government and private shipyards might be needed.

(U) The balancing of work loads among shipyards could create a crew and family morale problem with respect to homeport assignments and could affect crew retention rates. However, the impact on homeport assignments may be minimized if items (a), (b) and (c) are implemented in East Coast shipyards, because it is the East Coast- based nuclear submarines that cannot now be overhauled in East Coast commercial or Navy shipyards.

(U) We also recognize that Congressional action is required in order to implement this recommendation.

¹(U)Opinions differ as to the difficulty of obtaining such license. Officials at one currently licensed private yard indicated that about two years and \$100 million investment would be required.

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5. Industrial Base Reserve (U)

(U) Whatever the other choices, in order to provide for a contingent quick response construction capability, the Navy should undertake to construct ship lift and transfer systems at selected Navy shipyards such as Puget Sound, Mare Island and Portsmouth and perhaps eventually at all yards. Such systems should be designed to be compatible with the level building pre-assembly techniques at Electric Boat and Newport News. In the event of production interruption at assembly sites of Electric Boat and Newport News (or other builders for that matter), or if a surge in production were needed, the public yards could proceed to assemble and fit out hulls from modules obtained from the same sources as Electric Boat and Newport News.

(U) The full costs of implementing this and the previous recommendation have not been determined in this study.

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Chapter I INTRODUCTION (U)

A. PURPOSE OF THIS STUDY (U)

(U) The purpose of this study is to provide the Secretary of Defense with sufficient information on which to base his recommendation to the President concerning the potential construction of U.S. Navy ships in government shipyards, as required of the President by the Vinson-Trammell Act.¹ This decision must be made in time for the submission of the fiscal year 1983 budget. The "alternative vessel" provision of the Vinson-Trammell Act of March 27, 1934 requires that the first and each succeeding alternative warship be constructed in government shipyards. It also provides that the President may vary this pattern in any year in the public interest.

B. RECENT HISTORY (U)

(U) The last new construction ship project assigned to a government shipyard was in fiscal year 1966; the last ship constructed by a government yard was completed in 1972. Since 1966, the President, as advised by the Secretary of Defense, has recommended to Congress that all new naval ship construction be performed by private shipyards.

(U) The decisions since 1966 to confine new construction to private shipyards were based primarily on the assessment that these shipyards had ample capacity and capability to

¹(U)48 STAT 503 as reenacted by Section 302 of Public Law 89-37. The IDA task order to perform the study is provided in Annex A.

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construct the Navy's expected requirements and the ships were less costly. However, conditions have developed which now require an especially careful reconsideration of the role of government shipyards:

1. (U) A major build-up of naval surface and submarine forces is a reasonable certainty;
2. (U) The Government has encountered difficulties with the private shipbuilders with respect to
 - a. (U) delivery of ships on schedule (especially nuclear submarines),
 - b. (U) contractual matters, e.g., claims for additional funds, threats by key suppliers to discontinue U.S. Navy work;
3. (U) An increasingly heavy load of repair and overhaul of nuclear-powered ships, including refuelings, is competing for some of the same facilities and much of the labor that is qualified for nuclear construction. Accomplishing the projected nuclear ship construction program and the foreseeable overhaul program cannot be assured with the manpower and facilities currently available for these tasks;
4. (U) If they are not assigned new construction in the near future, government shipyards will lose their ship construction capabilities. There is particular concern about the retention of manpower with ship construction experience and the maintenance of a ship design and production engineering capability.

C. STUDY ASSUMPTIONS (U)

(U) The following assumptions have been made throughout this study:

1. (U) The naval shipbuilding rates of production will be as stated in the fiscal year 1983 Program Decision Memorandum (PDM-83) and the Extended Planning Annex (EPA). These rates are provided in Annex B of this report.

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2. (U) The volume of overhaul and repair of nuclear-powered warships which affects government and private shipyards currently considered for nuclear ship construction will continue at the levels projected by the Navy. Figure 1-1 summarizes combined construction and overhaul and repair projections.
3. (U) Private sector shipbuilders have sufficient unused capacity and the technical capability to produce all non-nuclear naval surface ships required by the PDM-83/EPA as well as to perform assigned overhaul and repair of non-nuclear naval ships. Therefore this study has been limited to a consideration of nuclear naval ship construction¹.
4. (U) The shipyards that currently have the technical capability and special qualifications for nuclear ship construction are listed below. Their geographic location is shown in Figure 1-2.

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	Private Shipyards		Government Shipyards		
Nuclear Ship Type	Newport News	Electric Boat	Puget Sound	Mare Island	Portsmouth
<u>Submarines</u>					
Trident	yes*	yes	yes*	No	No
SSN-688	yes	yes	yes*	yes*	yes*
<u>Surface Ships</u>					
CVN	yes	No	yes*	No	No
CGN-42	yes	No	yes*	yes*	yes*

* (U) Assumed capability. Has not actually constructed ships of this type.

¹ (U) Philadelphia and Long Beach Shipyards have already been assigned the carrier (SLEP) and battleship conversion programs, respectively.

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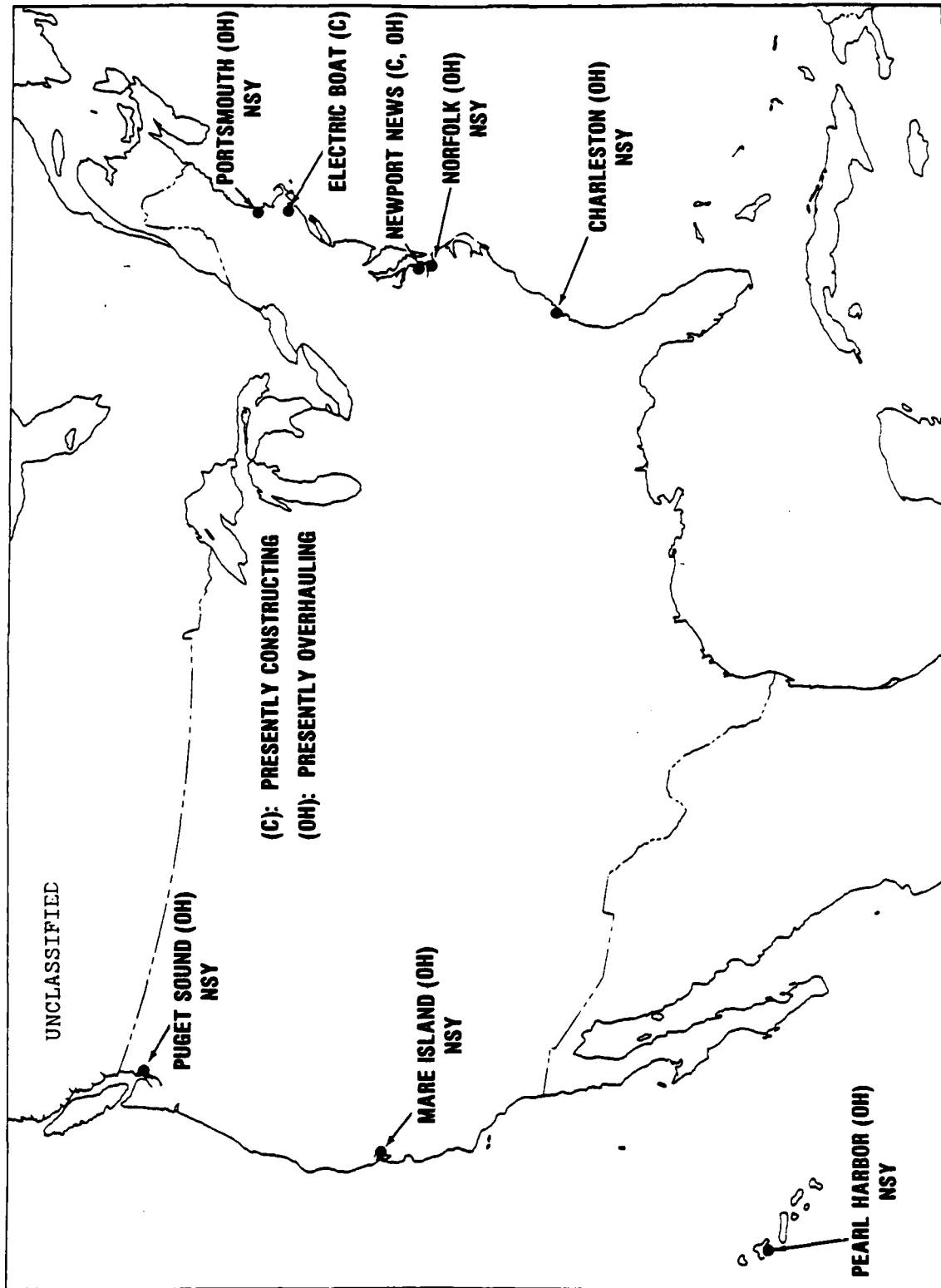


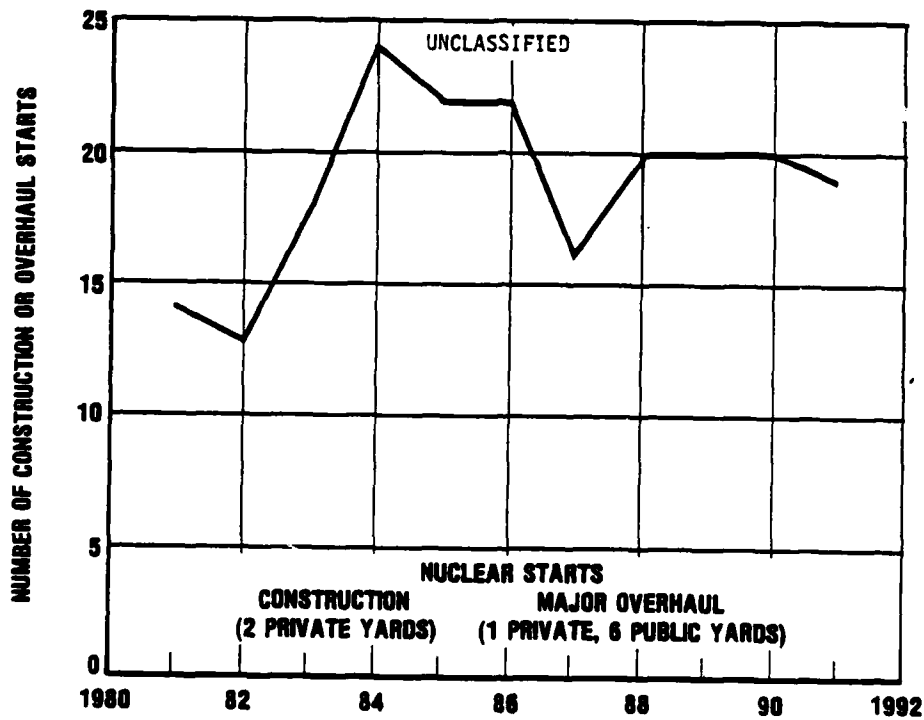
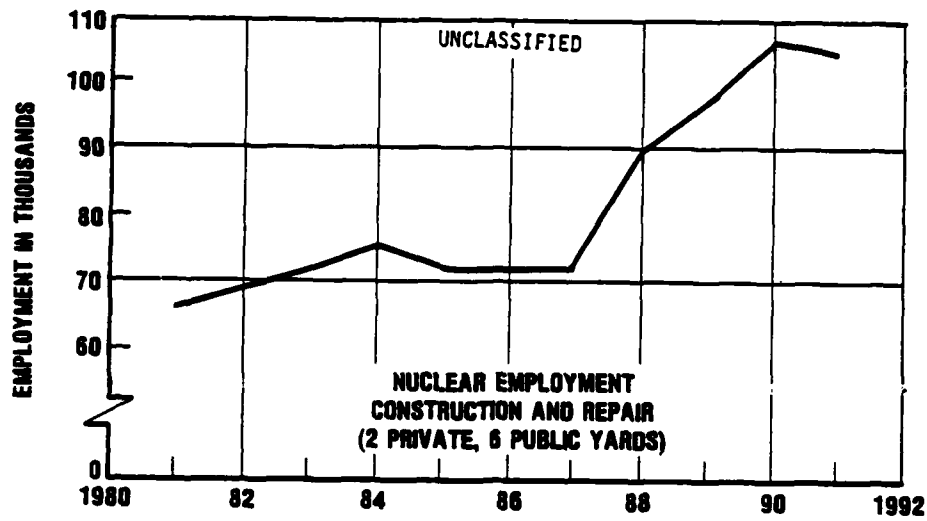
Figure 1-1. (U) LOCATION OF NUCLEAR SHIPYARDS

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NUCLEAR SHIPBUILDING INDUSTRY LOADING



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Figure 1-2. (U) NUCLEAR SHIPBUILDING INDUSTRY LOADING

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5. (U) Shipyards currently having the technical capability to overhaul and repair nuclear ships are as shown in Table 1-1.
6. (U) The number of man-hours of labor and the time pattern of application of that manpower for each class of ship are as predicted in the July 1981 Navy planning factors. Differences among selected shipyards, as used by NAVSEA, were not considered in this study because of computer programming considerations.
7. (U) The provision of an industrial base for a major expansion of nuclear ships after hostilities start is not considered. Construction times for nuclear shipbuilding are such that any project begun after hostilities commence could not reasonably be expected to significantly influence outcomes.

D. CRITICAL ASSUMPTIONS (U)

(U) Two study assumptions are crucial to an understanding the conclusions reached. One has to do with the "realism" of the Program Decision Memorandum construction plan of FY 1983 for 1983-1987 and the Extended Planning Annex covering the period up to 1997. Historically, both "forecasts" have projected much more ambitious programs of shipbuilding than were subsequently realized. Lacking any directive or authority to modify the plan, we use it to assess the problems involved in attempting to realize it. To anticipate the conclusions, we could say that the difficult problem of accommodating shipbuilding capacity to an ambitious program of nuclear cruiser construction after 1986 could be "solved" by simply abandoning that program. However, that is a major policy choice which is not within the scope of this study.

(U) The second crucial assumption has to do with the NAVSEA planning factors for manpower needed in ship construction and repair. The IDA computer model uses estimated mandays, a generalized curve of labor distribution

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Table 1-1. (U) SHIPYARDS WITH NUCLEAR SHIP OVERHAUL AND REPAIR CAPABILITY

UNCLASSIFIED									
Nuclear Ship Type	Private Shipyards			Government Shipyards					Pearl Harbor
	Newport News	Electric Boat	Puget Sound	Mare Island	Portsmouth	Charleston	Norfolk		
<u>Submarines</u>									
SSN	Yes	Yes ¹	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SSBN	Yes	Yes ¹	Yes	Yes	Yes	Yes ²	Yes	Yes	No
<u>Surface Ships</u>									
CVN	Yes	No	Yes	No	No	No	No	Yes	No
CGN	Yes	No	Yes	Yes ³	No	No	No	Yes	No

¹(U)No projects currently assigned.

²(U)Has not overhauled to date.

³(U)Secondary capability.

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over time, and estimated elapsed time for each phase of ship construction (award-to-start, start-to-keel, keel-to-launch, launch-to-delivery) to generate its results. These are produced by NAVSEA from its experience with builders and are updated periodically. The study used the factors reflecting experience up to early 1981. If future performance takes more labor and longer times (as NAVSEA is currently predicting) then our conclusions with respect to private capacity may be overly optimistic. The history of the 1970s, with cost overruns and late deliveries by private builders being a common occurrence, would suggest that our estimates of labor requirements are too low. On the other hand, the introduction of radically different building techniques at Electric Boat for nuclear submarines and at Newport News for CVN's could mean quite different applications of manpower than reflected in the historical factors. To the extent that our conclusions turn on these factors, they are more debatable than the subsequent text might suggest.

E. INFORMATION-GATHERING PROCEDURES (U)

(U) The basic information used in this analysis was obtained by

1. (U) Examining pertinent published documents developed during the period when government shipyards were actively engaged in ship construction;
2. (U) Analyzing recent proposals of government shipyards with respect to their capability and requirements if they were assigned nuclear surface and/or submarine construction;
3. (U) Visiting the three government shipyards considered by the Navy for new ship construction assignments and two private shipyards to discuss their capacities, technical capabilities and requirements and to inspect the physical facilities;

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4. (U) Consulting with knowledgeable military and civilian personnel in NAVSEA as well as with the IDA Steering Committee on various questions of planning, scheduling, management and data interpretation.

(U) The visits to the shipyards were especially helpful. Key personnel at each shipyard thoroughly briefed the study team as to yard capacities, capabilities, and requirements and were quite candid during the ensuing discussions. All shipyard representatives freely responded to questions and provided whatever information the study team requested.

(U) Because the government shipyards have not constructed Naval ships for nearly ten years, it was not possible to obtain current construction cost figures. The analysis of government versus private shipyard relative costs, therefore, was restricted to an examination of past relationships and an assessment as to whether or not these same relationships would exist in the future. Current relative wage rates as well as relative overhaul and repair manday rates were used as proxies to relative construction costs.

F. THE QUESTIONS TO BE ANSWERED (U)

(U) By restating the purpose of this study in the form of questions which the following chapters seek to illuminate, we obtain the following:

1. (U) Is new construction capacity needed in government shipyards either for use in the timely completion of the planned Navy shipbuilding program or as a reserve against contingencies?
2. (U) What are the relative costs and construction alternatives if active new construction in government shipyards were required?

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3. (U) If a reserve construction capacity in government yards is a current requirement, is an active construction program necessary to maintain it in viable condition?

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Chapter II

FUTURE SHIPBUILDING REQUIREMENTS AND CAPACITIES (U)

(U) The issue as to whether or not ships should be constructed in government shipyards depends heavily upon future shipbuilding requirements, especially for nuclear submarines and surface ships. Previous studies have indicated that there is sufficient private shipyard capacity to build expected requirements for non-nuclear surface combatants and auxiliaries.¹ However, private sector capacity to construct nuclear submarines is currently limited to Electric Boat and Newport News, and the latter is the only private company currently qualified to build nuclear surface ships.

(U) Thus, the issue reduces to whether or not nuclear ships should be constructed in government shipyards. This depends upon--

1. (U) the combined capacities of Electric Boat and Newport News to meet future requirements for nuclear submarines, and
2. (U) the capacity of Newport News to meet future nuclear surface ship requirements.

Any short-fall in Electric Boat/Newport News capacities would create a need for additional capacity; returning

¹(U)Reference [1] and subsequent applications of the IDA Ship Allocation System (IDASAS) computer program.

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government shipyards to new ship construction would be one option for eliminating this shortfall.¹

(U) In the discussion below we use the terms "capability" and "capacity." By "capability" we mean that a yard has the technical means, qualified manpower, and willingness to undertake one or more projects of building or repairing a particular type of ship. "Capacity" is used to refer to the quantitative measure of the amount of work of the particular kind which the yard (government or private) can complete in a unit of time.

A. PDM-83/EPA SHIPBUILDING REQUIREMENTS (U)

(U) The requirements of the fiscal year 1983 Program Decision Memorandum (PDM-83) and the Extended Planning Annex (EPA) are given in Annex B and summarized in Table 2-1. Nuclear ship requirements imply the following rates of production:

- (U) 1 TRIDENT submarine per year
- (U) 1 Nuclear aircraft carrier every two years
- (U) 3.3 Nuclear attack submarines per year
- (U) 1.5 Nuclear cruisers per year beginning in 1986
- (U) 1.5 Nuclear cruiser conversions per year beginning in 1987.

The nuclear cruiser conversions involve the installation of the Aegis system and simultaneously performing necessary overhaul and repair. The latter implies that the work must be performed in a nuclear-qualified shipyard.

¹(U) There are reasons for considering government shipyards for nuclear ship construction other than simply eliminating a short-fall. These are discussed in subsequent chapters.

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Table 2-1. (U) NUCLEAR SHIP CONSTRUCTION AND OVERHAUL DEMAND, 1980-1990

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SHIPYARDS AVAILABLE	TYPE OF AWARD	NUMBER OF STARTS OR AWARDS BY YEAR										
		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
0 PUBLIC 2 PRIVATE	NUCLEAR SUBMARINES - NEW CONSTRUCTION STARTS	3	3	2	4	5	5	5	5	4	5	5
6 PUBLIC 1 PRIVATE	NUCLEAR SUBMARINES - OVERHAUL STARTS	13	11	9	11	15	16	14	10	11	12	11
0 PUBLIC 1 PRIVATE	NUCLEAR SURFACE SHIPS - NEW CONSTRUCTION STARTS	1	0	0	0	1	0	1	1	2	2	2
2 PUBLIC 1 PRIVATE	NUCLEAR SURFACE SHIPS - OVERHAUL STARTS	0	1	1	3	2	2	1	1	0	1	2
TOTAL: ALL TYPES 6 PUBLIC 2 PRIVATE	ALL AWARDS	17	15	12	18	23	23	21	17	17	20	20

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(U) The PDM-83/EPA requirements and implied production rates are used as the basis for the analysis presented in the remainder of this study.

B. NUCLEAR OVERHAUL REQUIREMENTS AND CAPACITIES (U)

1. Nuclear Repair Demand by Ship (U)

(U) The schedule of nuclear repair and overhaul by ship types through the next decade is shown in Table 2-1. None of the nuclear ships contemplated in the PDM construction program will be scheduled for overhaul before the mid 1990s. The ships reflected are in operation or nearly completed. This schedule has some flexibility. Unless it is a refueling dictated by reactor core life, a scheduled overhaul can be postponed for months and even years, though with increasing risks of serious breakdowns. Nevertheless, the overhaul schedule has less flexibility (practically speaking) than construction schedules.

2. Nuclear Repair Demand For Manpower (U)

(U) Using its planning factors and the individual ships in the schedule (ships of a single class are often different in ways that affect repair), the Navy has produced a schedule of the employment load for nuclear repair scheduled through FY87 on the Naval shipyards and on Newport News. This is shown in Table 2-2. For Naval shipyards, the total nuclear repair load would generate an employment level of 31,400 in 1981, rising to 37,000¹ in 1985 and leveling off at about

¹(U)Some NAVSEA sources estimate that an employment level of 36,000 may be more likely.

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**Table 2-2. (U) NUCLEAR REPAIR AND OVERHAUL EMPLOYMENT
PROJECTIONS NEWPORT NEWS AND U.S. NAVY
SHIPYARDS¹**

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	Employment in Thousands	
	U.S. Navy Shipyards	Newport News
	Nuclear Repair	Nuclear Repair
1981	31.4	6.2
1982	33.7	8.4
1983	31.5	9.3
1984	37.3	8.7
1985	37.0	8.9
1986	36.0	9.8
1987	33.0	7.4
1988	34.3 ²	8.4
1989	34.3	8.4
1990	34.3	8.4
1991	34.3	8.4

¹(U)Source: NAVSEA estimates.

²(U)7-year average extended to 1991.

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33,000¹ in 1987 and beyond. For Newport News, the current level of 6,200 in nuclear repair is forecasted to rise to 9,300 in 1983 and then to 9,800 in 1986. These two peaks represent the first two overhauls of the Nimitz-class nuclear carriers.

3. Nuclear Repair and Overhaul Yard Capacities (U)

(U) The capacity of any yard to complete overhaul and repair is usually less limited by facilities than by manpower. The yard needs drydocks of the appropriate size and cranes of sufficient lifting capacity with fitting-out piers of appropriate length. These fixed facilities are utilized for shorter periods than for building, and varying amounts of above-the-waterline exterior and interior work can be accomplished while the ship is drydocked for its below-the-waterline and hull piercing work. The exact time at which a selected restricted availability (SRA) or a regular overhaul (ROH) must take place is also variable. Except for limited facilities such as carrier-capable drydocks, existing commercial and naval shipyards have more than enough space. The repair workload is limited at government shipyards by the number of workers available under fixed ceilings on total government shipyard employment. The projected rise of nuclear repair employment from 31 to 37 thousand (Table 2-2) indicates

¹(U)Unofficial NAVSEA estimate.

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a need for ceiling relief in the future for overhaul and repair load alone. However, only six of the U.S. Navy's eight shipyards are currently qualified for nuclear repair work, and only three of these still have a potential construction assignment. Table 2-3 shows the qualifications of the nuclear repair yard base, including Newport News.

(U) To obtain some idea of the quantitative measure of nuclear repair capacity we used the schedule of planned overhauls. The maximum number of concurrent regular overhauls of a particular type was obtained by counting. In some cases the numbers are not additive over types for a given yard; that is to say, a yard might have two regular overhauls for SSBN and one SSN planned in one period and four SSN and no SSBN overhauls planned in another interval. Our count of capacity would be 3-4 SSBN/SSN rather than 6 (2 SSBN + 4 SSN). Table 2-4 summarizes these data. In addition to regular overhauls, the yards also do other repair work not shown here. Note that only in the SSN/SSBN area does the requirement begin to approach capacity as measured by current assignment. For Navy yards, the capacity may be limited by manpower ceilings rather than facilities, so these figures are some sort of minimum.

(U) However, this represents a managed result, with some non-nuclear combat ship work normally assigned to government shipyards expected to be placed with private yards to make room within the ceiling for nuclear work. If this effort is unsatisfactory (combat ship repair is not lightly assigned by the Navy) or if nuclear overhaul workloads by ship type are higher than forecast, then demand may exceed capacity as early as FY 1984.

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Table 2-3. (U) NUCLEAR REPAIR AND OVERHAUL CAPABILITIES¹

UNCLASSIFIED YARD LOCATION	SHIP TYPE							
	CVN		CGN		SSBN		SSN	
	OVERHAUL ²	REPAIR ³	OVERHAUL	REPAIR	OVERHAUL	REPAIR	OVERHAUL	REPAIR
EAST COAST								
PORTSMOUTH NSY KITTEERY, ME					X	X	X	X
NORFOLK, NSY NORFOLK, VA	X	X	X	X			X	X
CHARLESTON NSY CHARLESTON, SC					X	X	X	X
NEWPORT NEWS SHIPBUILDING CO. NEWPORT NEWS, VA	X	X	X	X	X		X	
ELECTRIC BOAT ⁴ GROTON, CT					X	X	X	X
WEST COAST								
PUGET SOUND NSY BREMERTON, WA	X	X	X	X			X	X
MARE ISLAND NSY VALLEJO, CA							X	X
PEARL HARBOR NSY OAHU, HI							X	X

(U) ¹SOURCE: NAVSEA(U) ²"Overhaul" refers to regular overhaul (ROH) including possible refueling.(U) ³"Repair" refers to qualification to carryout selected restricted availability (SRA) operations as well as less extensive maintenance and refurbishment activities. Emergent repair not requiring drydocking can be carried out on almost any ship at any yard, depending of course on the exact nature of the damage or failure.(U) ⁴Since initiating the TINDENT program, EB has not been assigned (nor has it sought) SSBN or SSN overhauls at Groton; but it has all the requisite skills and facilities.

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Table 2-4. (U) NUCLEAR SHIP OVERHAUL RATES
(CAPABILITY VERSUS REQUIREMENT)

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Ship Type	Yard	Ships Per Year Regular Overhaul ^a Capacity	Requirement
CVN	Newport News	0.4	
	Puget Sound NSY	0.4 ^b	
	Norfolk NSY	0.4 ^b	
Total		1.2	0.7 ^c
CGN	Newport News	1.0	
	Puget Sound NSY	1.0	
	Norfolk NSY	1.0	
Total		3.0	2.0 ^c
SSN and SSBN	Newport News	3.0-4.0	
	Portsmouth NSY	3.0	
	Norfolk NSY	1.5	
	Charleston NSY	1.5	
	Puget Sound NSY	2.0	
	Mare Island NSY	3.0	
Total		14.0-15.0	10.0-15.0 ^c

^a(U) Estimated from projected assignments. Actual capacity might be less than the sum of capacity over all types.

^b(U) Based on PDM-83 and EPA.

^c(U) Estimated from planning schedules.

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C. FUTURE SHIPBUILDING CAPACITIES (U)

(U) Opinions differ as to whether the PDM-83/EPA rates of production will be achievable by Electric Boat and/or Newport News. The Navy's assessment, discussed below, is that there will be a short-fall of one SSN per year; this is used as the basis for recommending that Mare Island Shipyard be reactivated for SSN production. On the other hand, Electric Boat disagrees with the Navy with respect to its SSN production capacity and believes that it can produce all of the required Tridents and attack submarines. In addition, Newport News is confident that it can produce the nuclear surface ships at the required rate without jeopardizing its SSN production nor other projected Navy shipbuilding, overhaul and repair requirements. The IDA assessment leans toward the private sector judgment, but with reservations regarding the overhaul and repair loads and nuclear cruiser production.

(U) Assessments by the potential nuclear ship suppliers are presented first. Then the IDA analysis evaluates these assessments and introduces additional alternatives which should be considered.

1. Navy Assessment (U)

(U) The Navy's detailed assessment of the future attack submarine construction capacities of Electric Boat and Newport News is presented in Reference 2. The Navy's conclusion, with respect to existing capacity, is that

"The existing submarine construction base capacity is not more than three attack [nuclear] submarines per year when other demands on the shipyards [Electric Boat and Newport News] are taken into account and

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may be less if an expanded nuclear surface shipbuilding program is undertaken."¹

(U) Assuming that a four-submarine-per-year production rate is required, the above conclusion implies a short-fall of one SSN per year.²

(U) The rationale behind the Navy's conclusion may be summarized as follows:

a. (U) For technical reasons, Electric Boat is the only feasible shipyard for production of the Trident (SSBN) submarines. Present and future awards of this highest priority ship might impinge upon the yard's production of SSNs if the current backlog of Tridents and SSNs cannot be cleared up as rapidly as projected.

b. (U) Actual SSN delivery experience at Electric Boat indicates that

(U) "...it would not be prudent to rely on an output of more than 1.5 attack submarines per year from Electric Boat Division..."³

c. (U) If Electric Boat clears up its backlog and excess capacity exists, this excess

(U) "...would serve as a reserve to meet unforeseen contingencies and, very importantly, could be employed on submarine overhauls; desirably, submarines homeported in New London."⁴

d. (U) At Newport News, attack submarine construction competes for limited resources with nuclear aircraft carriers, nuclear cruisers, submarine overhauls and refuelings and with commercial work.

¹(U)Reference [2], page 1.

²(U)The PDM-83/EPA SSN-688 rate is 3.3 per year so that the short-fall would be 1/3 submarine per year.

³(U)Idem, p. 15.

⁴(U)Ibid.

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- e. (U) It is expected that expanded programs for nuclear aircraft carriers and cruisers, as well as continuing high levels of submarine overhauls and commercial work, will increase the pressure on resources at Newport News and soak up any additional labor resources that might be added. In any case, the yard would be operating well beyond what is regarded as the optimum level of employment (about 24,000 employees).
- f. (U) Based upon these expected future requirements and the historical performance of the yard,

(U) "...it is not considered to be prudent to rely on Newport News for an output of more than 1.5 attack submarines per year...."¹

- g. (U) Again, if excess capacity developed at Newport News

(U) "...it would be a valuable resource with which to meet contingencies."²

In particular, this would make available badly needed nuclear ship overhaul and refueling capacity on the East Coast.

(U) Thus, the Navy estimates that the future attack submarine capacity at Electric Boat and Newport News will be 1.5 submarines each; i.e., 3 submarines per year. This estimate assumes that the nuclear carrier and cruiser programs will be expanded at approximately the rates indicated in the PDM-83/EPA. The Navy has proposed the use of one government shipyard to offset the short-fall of one attack submarine per year.

(U) With relatively minor facility acquisitions (less than \$50 million), each of the three government shipyards with a construction mission has the capacity to construct one SSN-688 class submarine per year using conventional

¹(U)Idem, p. 17.

²(U)Ibid.

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technologies. Each shipyard would require an increase in manpower ceilings as well as other actions which would facilitate the construction program.

(U) However, each shipyard has recommended installation of ship lift and transfer systems which would take advantage of the cyclinder production capabilities of Electric Boat's Quonset Point facility. The cost of installing these facilities at the government shipyards ranges from \$89 to \$234 million. Two shipyards also assume that the Quonset Point facility would be willing to produce the cylinders. Under this plan the government shipyards would be assemblers and outfitters much as the Electric Boat Groton facility is used today. Theoretically, this procedure would take advantage of the skilled overhaul and repair work force already at the government yards. Most of the work requiring prefabrication skills would be shifted to Quonset Point.

2. Electric Boat Assessment (U)

(U) The General Dynamics, Electric Boat (EB) Division is dedicated primarily to submarine construction. It is currently producing Trident submarines and SSN-688-class nuclear attack submarines (see Figures 2-1 and 2-2). Large cylinders are produced and partially outfitted at EB's Quonset Point facility near Providence, Rhode Island. The cylinders are transported by barge to EB's Groton, Connecticut facility where the submarines are completed.

(U) Electric Boat officials claim¹ that they can currently produce at least the following combinations of nuclear submarines (per year):

¹(U)Conversations with the authors.

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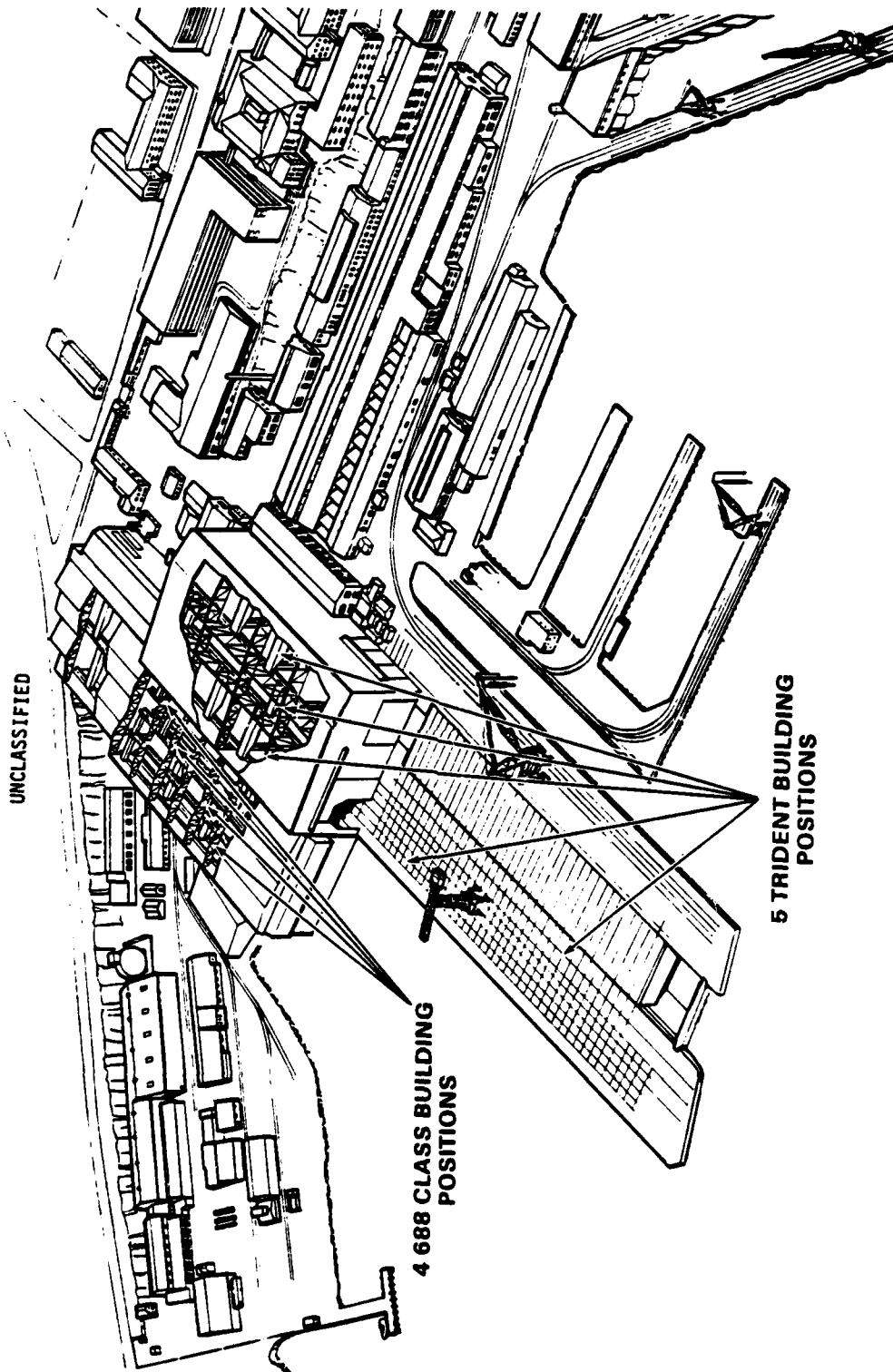
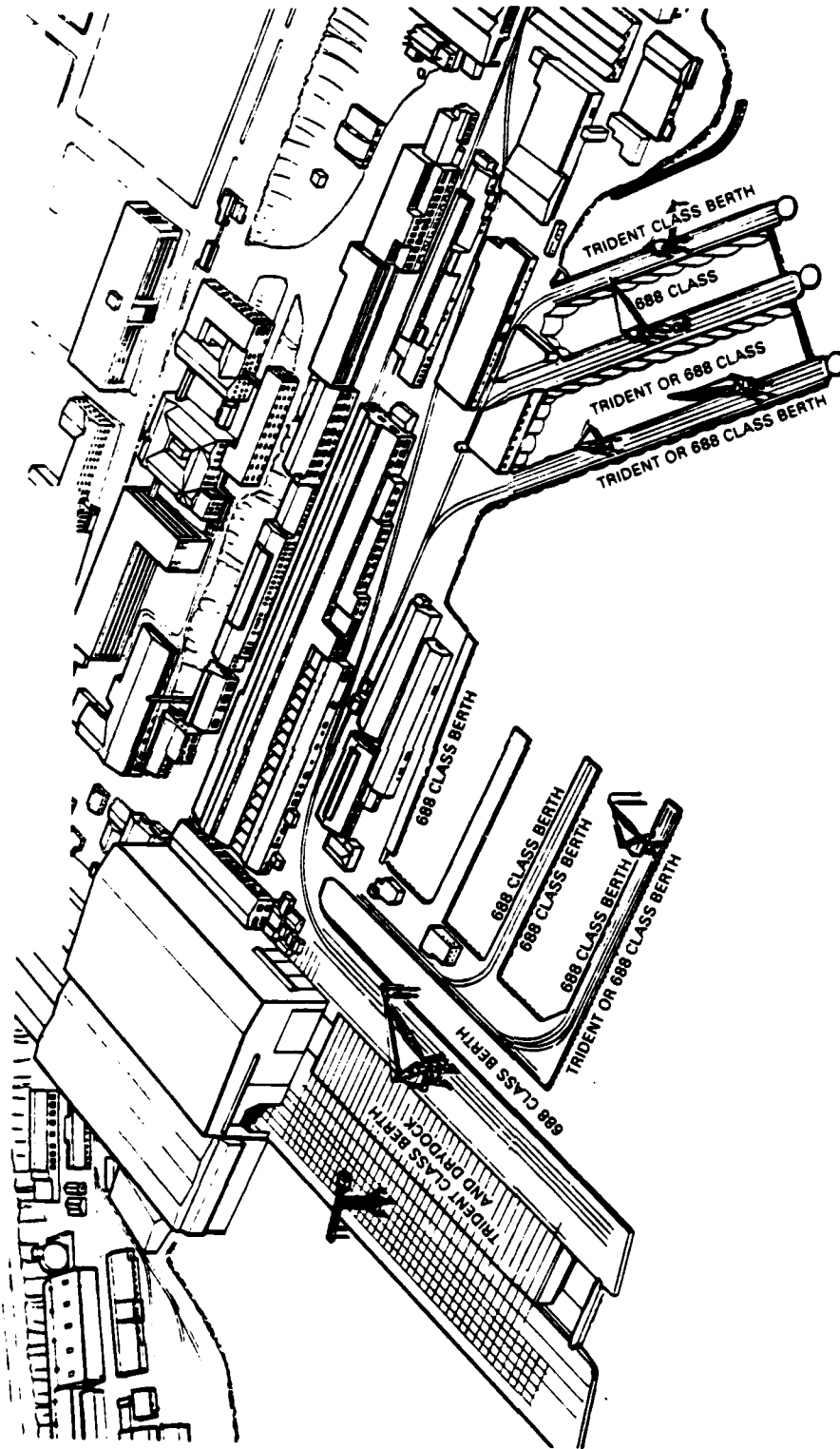


Figure 2-1. (U) ELECTRIC BOAT DIVISION BUILDING POSITIONS

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Figure 2-2. (U) ELECTRIC BOAT DIVISION BERTHING LOCATIONS

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<u>Tridents</u>	<u>SSN-688</u>
1 1/2	3
1	4

They recognize that they have had delivery problems in recent years, but point out that these have been cleared up and they can easily produce the above schedules. Figure 2-3 indicates the production schedule for Tridents and SSN-688s that have already been awarded to Electric Boat. Note that the planned delivery rate is about two per year, and construction times are gradually being reduced. Four of the delayed ships have already been delivered in 1981 and two were scheduled for delivery by the end of 1981.

(U) Electric Boat officials claim further that the shipyard's capacity can be increased by two to three attack submarines per year by increasing the lengths (reducing the number) of the SSN-688 cylinders and performing an even greater proportion of pre-packaging and outfitting at the Quonset Point facility. This would reduce the assembly time at the Groton facility so that through-put could be increased. Electric Boat also has the option of increasing its assembly and outfitting capacity if needed. Such an improvement, however, is conditioned on a major production engineering effort to redesign the SSN-688 for end-loading. The award of design responsibility for SSN-688 to Newport News resulted in a design utilizing conventional construction techniques.¹

¹(U)Electric Boat officials argue that obtaining Navy approval for changes in assembly procedures that were specified in the Newport News oriented contract is difficult, if not impossible. Some NAVSEA officials argue that the Navy is willing if not eager to consider such changes. However, they do emphasize that utilizing end-loading for SSN-688, similar to Trident, would require a costly and time-consuming effort in redesign.

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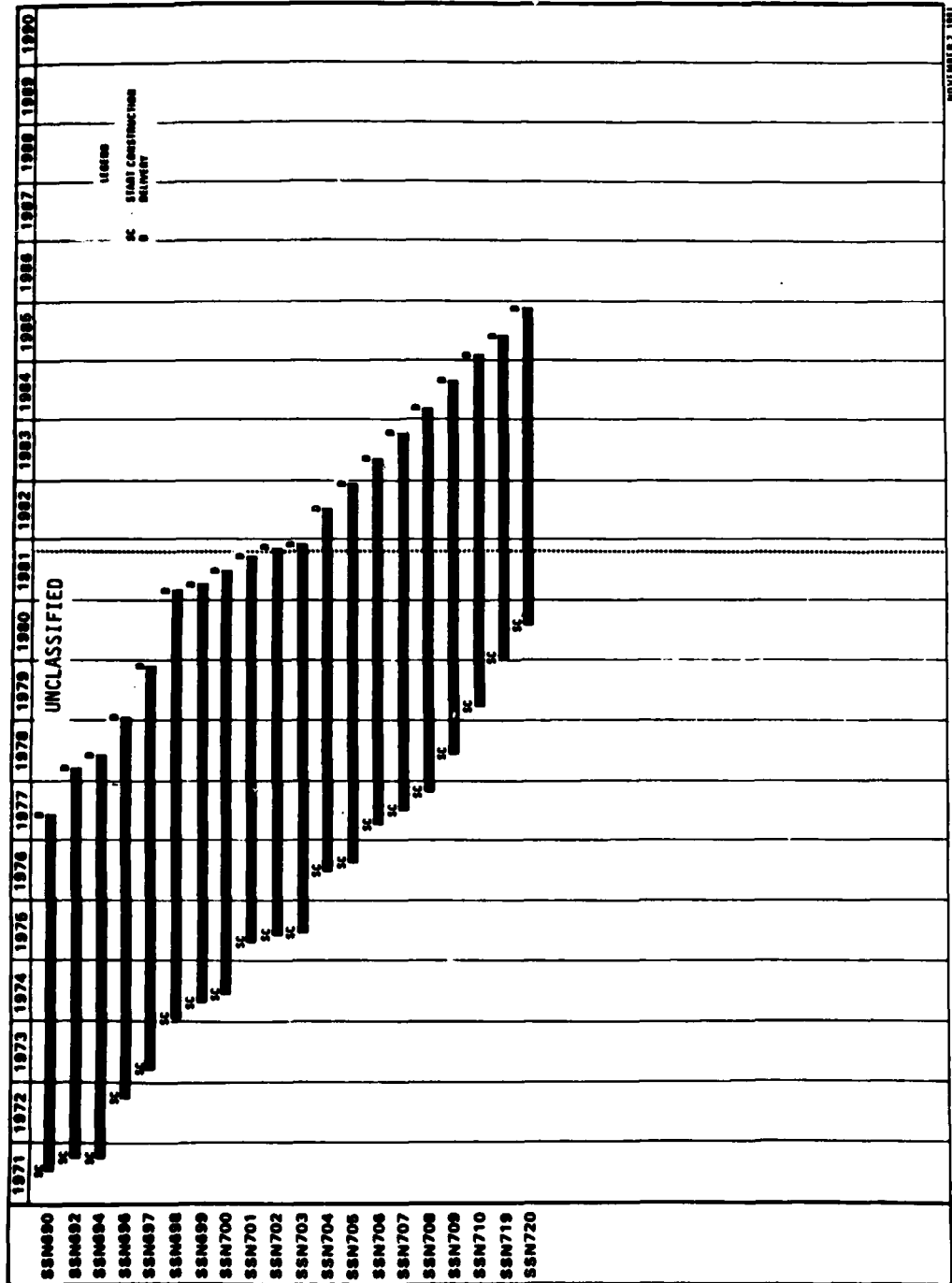


Figure 2-3. (U) SSN-688-CLASS PROGRAM SCHEDULE

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(U) The cylinder production methods at the company's Quonset Point facility represent an important technological advance in the production of Tridents and nuclear attack submarines. Although the current nuclear attack submarine cyclinders are still being outfitted by conventional top-loading methods, there is a clear potential for increasing productivity by adapting the production methods to the end loading methods used in Trident production.

(U) It should be noted also that all three government shipyards have proposed methods similar to Electric Boat and two would buy pre-outfitted cylinders from Quonset Point.¹

3. Newport News Assessment (U)

(U) Newport News officials claim that the shipyard can produce all the requirements of the PDM-83/EPA not assigned to Electric Boat and still handle the projected overhaul and repair requirements.² Their claim is based on the judgment that their CVN production productivity will be greatly enhanced by the dedication to CVN production of the 1600' x 250' graving dock, the pre-assembly area near the dock serviced by a 900-ton bridge crane and the adjacent large steel production facility (see Figure 2-4). These facilities make possible the pre-assembly and outfitting of very large (up to 900 tons) sections. Way 11 in the south yard would also be dedicated to nuclear carrier production (see Figure 2-5).

¹(U)Quonset Point currently has capacity for producing cylinders well above its projected order level for Tridents and SSN-688s.

²(U)Letter from Edward J. Campbell, President and Chief Executive Officer, Newport News Shipbuilding and Drydock Company, December 18, 1981.

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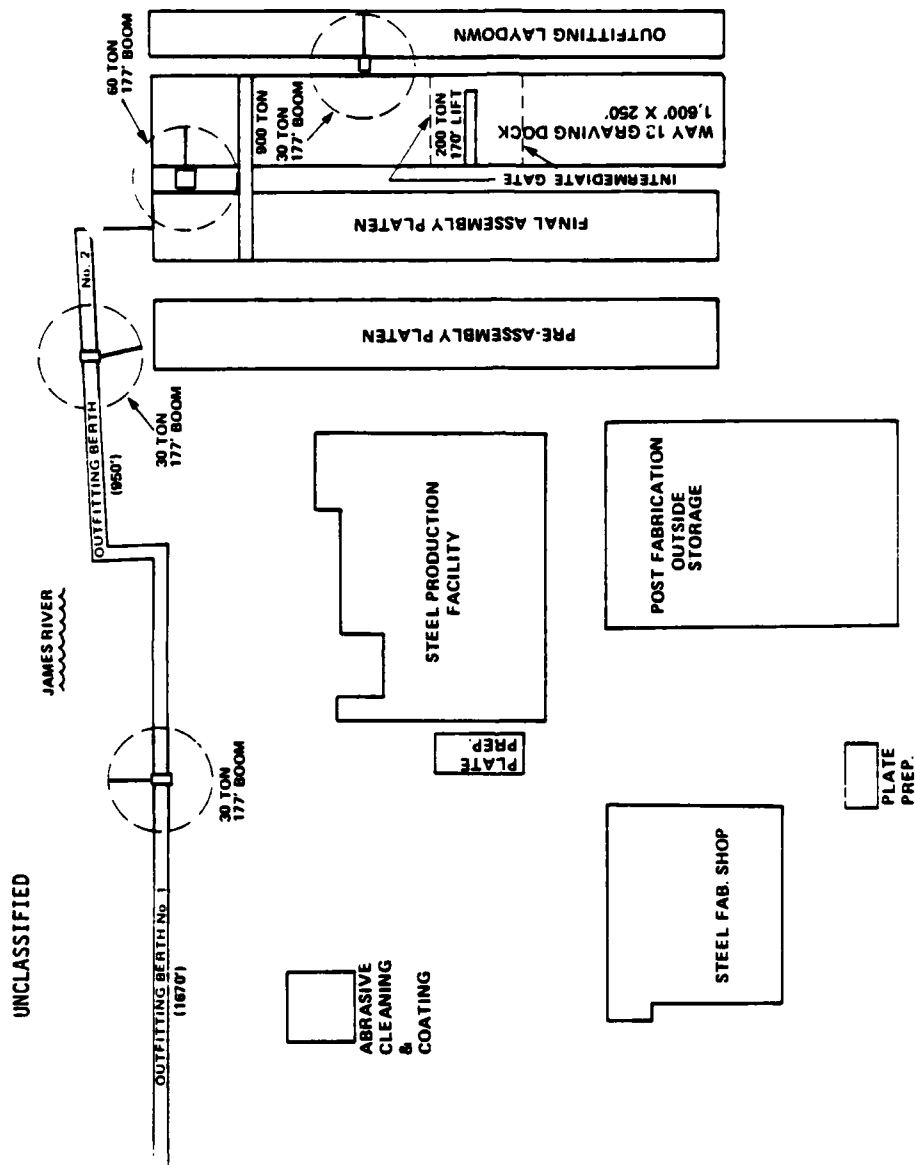
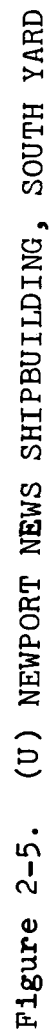


Figure 2-4. (U) NEWPORT NEWS SHIPBUILDING, NORTH YARD

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(U) Newport News also projects advancements in its submarine cylinder production.¹ Presumably this would be similar to the methods used at Quonset Point. The current submarine construction area (Ways 5 and 6 in Figure 2-5) would not be affected by the CVN construction, although part of the steel production facility would be used in cylinder production.

(U) Figures 2-4 and 2-5 indicate that the shipyard has additional building way capacity (e.g. Ways 8, 9 and 10) to build nuclear cruisers or submarines, as well as drydock capacity for overhaul and repair (Drydocks 1, 2 and 3). Piers 5, 6 (being rebuilt) on the South yard and Outfitting Birth and No. 1 in the North Yard can be used alternatively for nuclear carrier outfitting and/or overhaul and repair.

(U) Although it is evident that Newport News has the necessary production facilities, a question arises as to whether an adequate labor force can be acquired to perform all the work. Company officials claim that new nuclear surface ship and submarine production facilities and methods already incorporated in the yard will substantially reduce construction time requirements relative to conventional methods. The projected program can be handled with a total employment of about 31,000 (current employment is about 24,000). However, two important conditions must be present if the production methods are to be fully successful:

- (U) The Navy's ship acquisition plan for Newport News needs to be stabilized as to the probable number and types of ships to be built over the next ten years.

¹(U)Currently, the shaped plates are received from Vickers, Canada and welded into cylinders at Newport News. An automated facility for producing cylinder sections apparently is in planning.

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- (U) Authorizations (contracts) for new construction need to be firmed up so that procurement plans for materials and equipment can be developed as soon as possible.

(U) These two conditions are very important, because the new production methods involve a much higher degree of pre-packaging and outfitting of large ship sections or modules. This implies that a much higher percentage of materials and equipment must be purchased early in the production process than has been the case for the conventional production process. A stable and certain order book would not only help substantially in the shipyard's efforts to optimize equipment and materials procurement, but it would greatly enhance labor acquisition procedures. Previous experience has demonstrated that labor buildups which are too rapid can cause serious disruptions in the production processes and, therefore, increase production costs. Newport News officials indicate that the shipyard can handle a net buildup of about 1,000 - 1,500 persons per year without much difficulty.¹

4. IDA Assessment (U)

a. The Capacity Issue (U)

(U) The capacity issue involves two basic questions:

1. (U) Are the physical facilities at Electric Boat and Newport News adequate to produce the PDM-83/EPA nuclear ship requirements?
2. (U) Can the two shipyards acquire and train the necessary labor force to produce the ships efficiently?

¹(U)Electric Boat's production problems in the early 1970s were attributed primarily to a labor force buildup which overtaxed training personnel and facilities.

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With respect to the physical facilities question, there is a general consensus that the combined capacities of the two yards are adequate. As the result of discussions with Navy experts, officials at the two private shipyards, and actual inspection of the facilities, the IDA study team agrees with this conclusion.

(U) However, the question as to whether the shipyards can acquire and train the necessary labor force is controversial. The Navy is especially concerned about the future work load at Newport News. Currently, this shipyard is the only qualified yard for the production of nuclear surface ships and is expected to have a major nuclear ship overhaul and repair load. Along with Electric Boat, the yard is a major producer of nuclear attack submarines. The Navy believes that Newport News will encounter serious labor force problems if it is assigned all of the projected construction, overhaul and repair work load, and this can lead to production delays and, perhaps, cost overruns. Moreover, if Newport News is assigned only nuclear surface ships, or limited to a few nuclear attack submarines, the Navy doubts whether Electric Boat can handle the additional labor force requirements for producing attack submarines without impinging upon the Navy's highest priority Trident program.

(U) Spokesmen at both Electric Boat and Newport News disagree with the Navy's position. Electric Boat officials claim that their labor force problems are behind them and the lessons learned from dealing with these problems will assure that they will not occur again. Moreover, new production methods developed for the Trident program can be applied to attack submarines, so that the new labor force requirements will be well within the yards' labor recruitment and training capacities. However, the qualifications noted earlier, that

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major redesign would be required, needs to be taken into consideration.

(U) Newport News officials argue that their production methods for CVNs and other surface ships will reduce the total time required to build hull structures by a factor of about 25 percent. They also see no major difficulty in acquiring and training the additional labor force needed.

(U) It should be pointed out that both private suppliers emphatically recommend that the Navy adopt a balanced ship acquisition program which will allow the yards to acquire and train personnel at a reasonable and constant rate. Both indicate that they can add about 1,000-1,500 employees per year without serious disruptions.

(U) Thus, the capacity issue boils down to whether or not the two private shipyards can handle the additional labor requirements. To obtain a better idea of the nature of the labor problem, several alternative allocations of the PDM-83/EPA requirements were explored using the IDA ship allocation system (IDASAS) computer program. The results are discussed below.

b. IDASAS Assumptions (U)

(U) The IDASAS model assumes the following:

1. (U) The private shipyards have the physical capacity to produce the PDM-83/EPA nuclear ships as assigned.
2. (U) The three government shipyards have the capacity to produce at least one SSN-688 per year. Puget Sound is the only shipyard available for nuclear surface ship construction.
3. (U) The ships are produced according to the Navy's planning factors with respect to months between key benchmarks, i.e., months between

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- (U) contract award to start of construction,
 - (U) start of construction to keel laying,
 - (U) keel laying to launch,¹
 - (U) launch to delivery.
4. (U) The labor curves for each stage are those provided by the Navy.
 5. (U) The total man days for ship construction are as given by the Navy in July 1981.
 6. (U) The rate of labor acquisition is not constrained. This was necessary in order to determine the effect of the allocations on shipyard employment levels.

Although the Navy planning factors take into consideration both historical and projected performance of the shipyards, the private shipyards might contend that the building times are too long and the labor levels too high.

c. Employment at Electric Boat (U)

(U) Table 2-5 and Figure 2-6 show the production employment levels at Electric Boat under three alternative SSN-688 workloads. Each alternative includes the employment generated under the PDM-83/EPA Trident requirements.

(U) The first alternative assumes that Electric Boat will be the priority shipyard for SSN-688s as well as the Tridents. Note that the rate of production fluctuates between two and four submarines per year and the employment levels build up to about 30,000 employees. According to the IDASAS allocation, even if Electric Boat were given priority, the shipyard would run into a physical constraint in 1987 and would not be able to produce all the SSN-688s. The numbers

¹(U) This is the period for building position (drydock, sliding way, land level position) occupancy.

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Table 2-5. (U) SHIP CONSTRUCTION EMPLOYMENT AND SSN-688 WORKLOADS
AT ELECTRIC BOAT UNDER ALTERNATIVE SSN-688 ASSIGNMENTS
(Employment in Thousands)

Fiscal Year ¹	UNCLASSIFIED				Electric Boat SSN Workload		
	Employment ²		SSN-688 Priority To EB		SSN-688 Priority To EB	1 SSN Per Year Elsewhere	2 SSNs Per Year Elsewhere
Current Level	SSN-688 Priority To EB	1 SSN Per Year Elsewhere	2 SSNs Per Year Elsewhere				
1983	16.0	16.0	16.0				
1984	18.9	18.9	18.9		2 (0)	1 (1)	0 (2)
1985	17.2	16.6	16.6		4 (0)	3 (1)	2 (2)
1986	15.1	13.8	13.1		3 (0)	2 (1)	1 (2)
1987	15.5	13.8	13.1		4 (0)	3 (1)	2 (2)
1988	24.0	20.3	17.1		2 (2)	3 (1)	2 (2)
1989	27.3	23.4	19.6		3 (0)	2 (1)	1 (2)
1990	26.7	23.8	19.3		2 (1)	2 (1)	1 (2)
1991	29.8	28.8	23.4		2 (2)	2 (2)*	2 (2)
1992	28.3	27.3	22.4		2 (1)	2 (1)	1 (2)
1993	29.3	29.5	23.4		3 (0)	2 (1)	1 (2)
1994	30.0	28.3	24.9		3 (1)	3 (1)	2 (2)
	29.8	29.5	26.0		2 (1)	2 (1)	1 (2)

Source: (U)IDASAS Projections.

¹(U)End of year.

²(U)Includes Trident employment.

* (U)Variation from rate of one per year due to capacity limitations at EB.

Note: (U)Figures in parentheses indicate number produced elsewhere.

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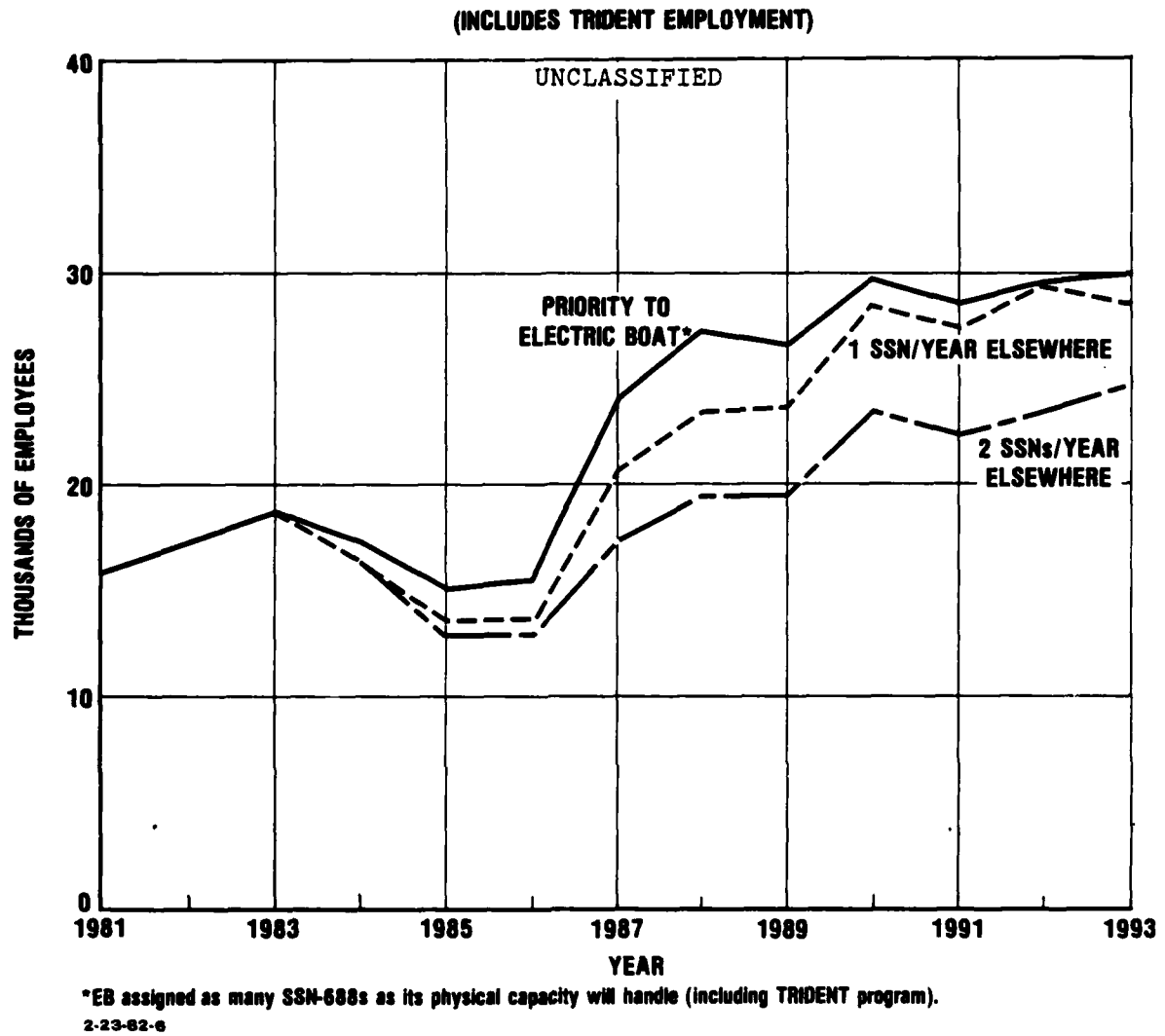


Figure 2-6. (U) TOTAL EMPLOYMENT AT ELECTRIC BOAT
ALTERNATIVE SSN-688 ASSIGNMENTS

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that would have to be produced elsewhere are given in the parentheses. Thus, the flattening out of the employment curve at about 30,000 represents a physical constraint rather than an employment constraint.

(U) The second alternative assumes that the Electric Boat SSN-688 workload is reduced by one per year beginning in 1983.¹ Under this alternative, the employment buildup at the shipyard is reduced in the earlier years, but by 1990 it reaches about the same levels as under the priority case, i.e., just under the physical capacity limits.

(U) The third alternative assumes that two SSNs per year would be produced elsewhere. Here the employment buildup is more gradual and is always well below the physical capacity limitations.²

(U) It is important to recognize that all three alternatives have unrealistic employment surges from 1986 to 1987. These surges are caused by the shape of the labor curves in the IDASAS program which represent the schedules for applying the labor to the production process. The acquisition and training of personnel would have to be accomplished on a

¹(U)Note that the 1990 value produced elsewhere is 2. This is due to capacity limitations at Electric Boat.

²(U)The average rate of SSN-688 production at Electric Boat would be about 1.3 per year. This is the rate that the Navy believes is the prudent level. Electric Boat officials claim that this rate can be accomplished with an employment level under 20,000.

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more gradual schedule, otherwise production bottlenecks would develop.¹

(U) To sum up to this point, the IDASAS allocation--based on Navy planning factors--indicates that Electric Boat can produce all the Tridents required by the PDM-83/EPA and most of the SSN-688s.² However, beginning in 1987 the limits of the physical capacity of the shipyard would be reached so that some of the attack submarines (about one per year) would have to be produced elsewhere, e.g., at Newport News or a government shipyard.

d. Employment at Newport News (U)

(U) Because Newport News is scheduled to perform overhaul and repair and construct both nuclear attack submarines and nuclear surface ships, two sets of options were explored using the IDASAS program. The first set assumes that the nuclear cruiser construction and conversion programs would not be assigned to the shipyard. The yard would be assigned the entire nuclear aircraft carrier (CVN) construction program, plus the following SSN-688 options:

- (U) No SSN-688s
- (U) One SSN-688 per year starting in 1983,
- (U) Two SSN-688s per year starting in 1983,
- (U) The SSN-688s that are not produced by Electric Boat as a result of capacity limitations, i.e., the SSN priority to Electric Boat option.

¹(U)As noted earlier, Electric Boat's problems in the 1970s seem to have been due largely to excessive rates of labor build-up, resulting in skill dilution and consequent failure of quality control procedures.

²(U)This assumes that 30,000 employees is the correct maximum. The Navy disagrees with this figure and believes it should be reduced to about 24 thousand.

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(U) The second set of options assumes that the CVN, nuclear cruiser construction, and nuclear cruiser conversion programs would be assigned to Newport News plus one of the above SSN-688 options. Both sets are examined with and without the overhaul and repair (OH&R) load.

(U) (1) No Nuclear Cruiser Programs--The IDASAS projected employment levels for the no-cruiser options appear in Table 2-6 and Figure 2-7. Consider first the zero-SSN option with no overhaul and repair (the dotted curve in Figure 2-7). This would be the case where the shipyard would construct only the nuclear carriers.¹ Here construction employment would reach a peak of about 16,100 in 1992. When the overhaul and repair load is added, the maximum employment would be 24,900. These are employment figures well within the shipyards current acquisition and training capacity.

(U) Now consider the two-SSN per year option in Table 2-6 and Figure 2-7. For this option, construction employment climbs to 22,400 in 1991 and stays relatively flat from that point on. When overhaul and repair is added, total production employment hovers around 30,000 from 1989 on. Newport News representatives argue that a level of 30,000 - 32,000 total employment is achievable provided the labor force can be acquired and trained gradually. The surge from 1986 to 1989 of 3,000-4,000 per year should be avoided if at all possible (see Figure 2-7).

(U) Thus, Newport News would appear to have both the physical and employment capacity to handle the CVN program plus two SSNs per year, as well perform the projected overhaul

¹(U)Note that beginning in 1987 an additional shipyard (e.g. a government yard) would have to be assigned those SSN's which Electric Boat could not handle.

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Table 2-6. (U) TOTAL EMPLOYMENT LEVELS AT NEWPORT NEWS UNDER ALTERNATIVE SSN-688
ASSIGNMENTS - NO NUCLEAR CRUISERS
(Thousands of Employees)

Fiscal Year ¹	UNCLASSIFIED							
	Construction Only ²				Construction Plus Scheduled OH&R ²			
	0 SSNs Per Year ³	1 SSN Per Year ⁴	2 SSNs Per Year	0 SSNs Per Year	1 SSN Per Year	2 SSNs Per Year	0 SSNs Per Year	1 SSN Per Year
Current Level	12.0	12.0	12.0	20.4	20.4	20.4	20.4	20.4
1983	14.4	14.4	14.4	23.8	23.8	23.8	23.8	23.8
1984	12.4	12.4	12.4	21.2	21.2	21.2	21.2	21.2
1985	12.1	12.1	12.1	21.0	21.0	21.0	21.0	21.0
1986	12.0	12.0	12.0	21.8	21.8	21.8	21.8	21.8
1987	9.8	12.9	15.0	19.4	20.3	22.4	22.4	22.4
1988	11.2	15.4	18.0	20.0	24.2	26.8	26.8	26.8
1989	13.3	18.2	21.1	22.1	27.0	29.9	29.9	29.9
1990	14.4	18.7	21.5	23.2	27.5	30.3	30.3	30.3
1991	15.2	20.1	22.4	24.0	28.9	30.2	30.2	30.2
1992	16.1	20.5	21.8	24.9	29.3	30.6	30.6	30.6
1993	16.0	21.5	22.6	24.8	30.3	31.4	31.4	31.4

¹ (U) End of year.

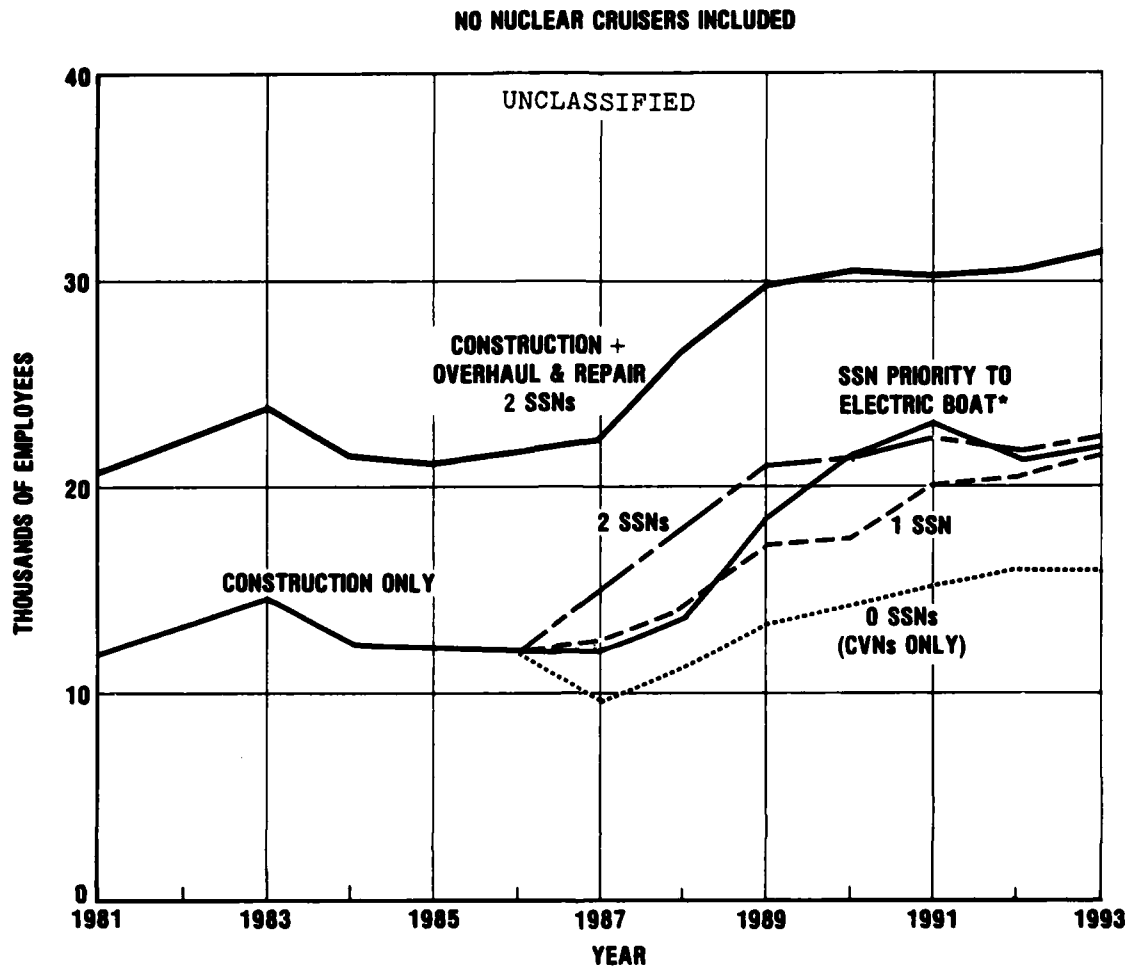
² (U) Includes civil employment.

³ (U) Civil-only employment.

⁴ (U) Two SSNs were assigned in 1990 because of capacity limitations at Electric Boat. Initially, there is about a 2.8 thousand employee difference between a 1 SSN per year program and a 2 SSN per year program. The additional SSN in 1990 caused the two employment streams to converge after 1992.

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*EB assigned as many SSN-688s as its physical capacity will handle (including the TRIDENT program).

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Figure 2-7. (U) TOTAL EMPLOYMENT LEVELS AT NEWPORT NEWS UNDER ALTERNATIVE SSN ASSIGNMENTS

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and repair assignments. Navy representatives argue that while the capability of the management to direct such a large force is conceded, they question the ability of the Norfolk area labor market to supply the numbers and skills required.

(U) (2) Nuclear Cruiser Programs Added--Table 2-7 and Figure 2-8 show the employment levels at Newport News when the nuclear cruiser programs are added to the workload. Consider first the zero-SSN per year option. This is the case where the shipyard would construct only nuclear surface ships. Any SSNs not produced by Electric Boat would be produced by another shipyard, e.g., a government yard. Under this option employment at Newport News would increase from 10,400 in 1987 to 32,400 in 1990, an increase of over 7,000 per year. Moreover, employment drops after 1991 down to a level of about 26,000 in 1993. These are conditions which imply a very costly and, perhaps, wasteful employment process. The surge rate might be impossible to achieve, and employee retention rates would undoubtedly be adversely affected by the prospect of short-term employment.

(U) The addition of the overhaul and repair requirement would increase the peak (1990) employment level to 41,100 for the zero-SSN per year option and 48,100 for the two-SSN per year option (see Table 2-7). These are levels which would clearly tax all the yard's acquisition and training resources. Again, the surge rate caused by the cruiser programs would be the main problem. Presumably, the SSN and overhaul and repair programs could be insulated from any adverse effects because they have somewhat different labor force and facility requirements. However, whether or not the CVN construction program could also be insulated is a matter which would require careful study. The similarity of resource requirements suggests a potential for conflicts, but this

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Table 2-7. (U) EMPLOYMENT LEVELS AT NEWPORT NEWS UNDER ALTERNATIVE
SSN-688 ASSIGNMENTS - ALL NUCLEAR SURFACE SHIPS INCLUDED
(Thousands of Employees)

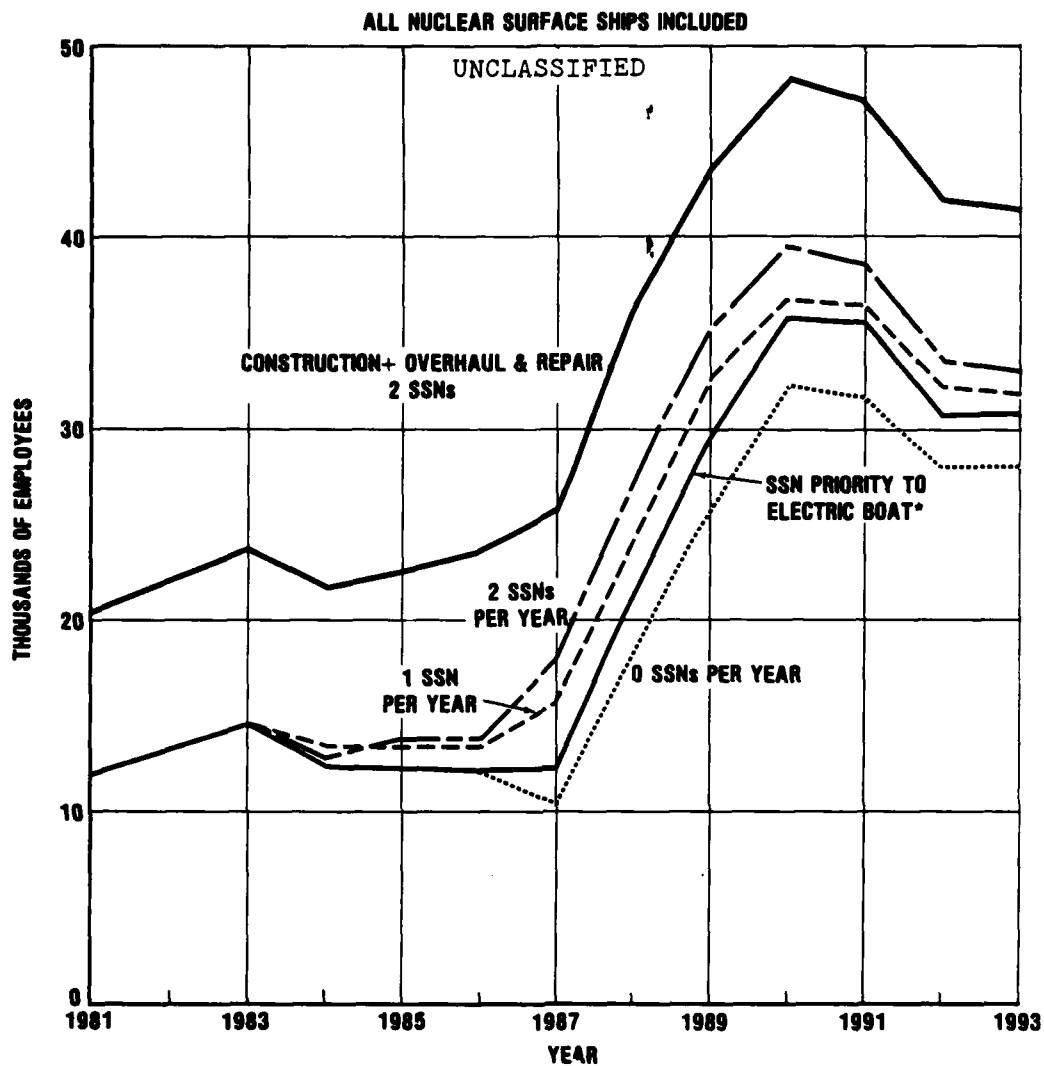
Fiscal Year ¹	UNCLASSIFIED							
	Construction Only				Construction Plus OH & R			
	0 SSNs Per Year	1 SSN Per Year ²	2 SSNs Per Year	0 SSNs Per Year	1 SSN Per Year	2 SSNs Per Year		
Current Level	12.0	12.0	12.0	20.4	20.4	20.4		
1983	14.4	14.4	14.4	23.8	23.8	23.8		
1984	12.4	13.0	13.0	21.2	21.8	21.8		
1985	12.1	13.2	13.7	21.0	22.0	22.5		
1986	12.0	13.2	13.7	21.8	23.0	23.5		
1987	10.4	15.8	17.9	19.5	23.2	25.3		
1988	20.4	24.6	27.2	29.2	33.4	36.0		
1989	27.2	32.1	35.0	36.0	40.9	43.8		
1990	32.3	36.6	39.4	41.1	45.4	48.1		
1991	31.3	36.2	38.5	40.1	45.0	47.3		
1992	27.7	32.1	33.4	36.5	40.9	42.2		
1993	26.4	31.9	33.0	35.2	40.7	41.8		

(u) ¹End of year.

(u) ²One extra in 1990.

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2-23-82-5 *EB assigned as many SSN-688s as its physical capacity will handle (including TRIDENT program).

Figure 2-8. (U) SHIP CONSTRUCTION EMPLOYMENT LEVELS
AT NEWPORT NEWS UNDER ALTERNATIVE
SSN-688 ASSIGNMENTS

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might be avoided by careful planning and resource management procedures.

e. Employment Levels for Selected Programs (U)

(U) Table 2-8 presents employment levels that would be generated by optional SSN production outside Electric Boat and the individual nuclear cruiser programs. For example, if a government shipyard were assigned the SSN-688s that could not be produced by Electric Boat under the "priority to Electric Boat" option, the employment stream would be approximately as shown under option A. At an SSN rate of production of one per year starting in 1983, the employment stream would be as shown under option B, and so on. Each of these streams represents the approximate increases in naval shipyard ceilings that would be required if production were to be performed in a government shipyard.

f. IDA Assessment Conclusions (U)

(U) The following conclusions by the study team are based upon

- (U) Direct discussions with Navy and private shipyard representatives,
 - (U) Direct observation of the facilities at the candidate government shipyards and the two private yards, and
 - (U) The foregoing IDASAS analysis.
1. (U) Taken together, Electric Boat and Newport News have the resource capacity to construct the CVNs and SSN-688s in the PDM-83/EPA. Newport News can also perform the overhaul and repair requirements. There would appear to be no serious problems in acquiring and training the necessary labor force. Whether it could be retained if industrial prosperity returns, particularly in construction, has been raised as an issue.

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Table 2-8. (U) EMPLOYMENT GENERATED BY SELECTED PROGRAMS
(Employment in Thousands)

UNCLASSIFIED									
Fiscal Year ¹	SSNs Not Produced by Electric Boat				Employment Generated by Cruiser Programs				
	Priority of SSNs	SSNs to EB		2 Per Year Rate	CGN-38 Conversions	CGN-42 Construction	Total		
		Employment	1 Per Year Rate ²						
		Option A	Option B	Option C	Option D	Option E	Opt. F		
1983	C	-	-	-	-	-	-		
1984	0	-	-	-	-	-	-		
1985	0	-	-	-	-	-	-		
1986	0	-	-	-	-	-	-		
1987	2	-	3.1	5.2	2.0	0.8	2.8		
1988	0	1.7	4.2	6.8	5.2	4.0	9.2		
1989	1	2.7	4.9	7.8	5.2	8.7	13.9		
1990	2	4.4	4.3	7.1	5.2	12.6	17.8		
1991	1	5.1	4.9	7.2	3.2	12.8	16.0		
1992	0	3.9	4.4	5.7	-	11.6	11.6		
1993	1	5.5	5.5	6.6	-	10.4	10.4		

(w) End of year.

(w) ?One extra in 1990.

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2. (U) The addition of the cruiser programs would have a major impact on Newport News operations irrespective of its level of SSN production. This implies that a reduction of the number of SSNs assigned to the shipyard would have a minor impact on the resolution of the cruiser program employment acquisition and training problem.
3. (U) From the standpoint of capacity, the Navy should concentrate on options relating to the nuclear cruiser programs rather than the attack submarine program. There is no need for additional SSN-688 capacity under the PDM-83/EPA requirements. If the Navy desires to construct ships in government shipyards, it might consider the cruiser program rather than the attack submarine program.
4. (U) If the Navy wants Newport News to construct the nuclear cruisers, more realistic procurement schedules need to be worked out. The PDM-83/EPA schedule implies unsatisfactory employment surge requirements.
5. (U) If a program trade-off becomes necessary at Newport News due to the nuclear cruiser program, the Navy might consider reducing or eliminating the yard's overhaul and repair workload. However, Newport News may need to retain overhaul and repair as a profitable load-leveler for its labor force.

(U) The foregoing conclusions have focused specifically on capacity issues. The next chapter examines an additional major issue--relative costs between government and private shipyards--that has a bearing on whether or not ship construction should be reinstituted in government shipyards.

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Chapter III

RELATIVE COSTS OF SHIP CONSTRUCTION IN GOVERNMENT SHIPYARDS (U)

A. GENERAL APPROACH (U)

(U) A direct comparison of current shipyard construction costs between government and private shipyards is not possible. Government shipyards have not been engaged in new ship construction since 1972, when the last SSN was delivered by Mare Island Naval Shipyard (see Table 3-1). The last new construction ship project assignment to a government yard was in fiscal year 1966. For these reasons it is necessary to use as a starting point of this analysis the most recent comprehensive study of relative shipyard costs, the 1972 Booz-Allen Study.¹ This study examined relative construction costs of comparable shipwork completed in government and private shipyards during fiscal years 1966 through 1971; i.e., during the most recent years of construction in government yards.

(U) The general approach in this chapter will be first to review the Booz-Allen Study to determine the conditions which evidently caused higher costs in government shipyards (Section B). Then, in Section C, the current situation will be examined to determine if similar conditions would be present with respect to the proposed nuclear shipbuilding program.

¹(U)Booz-Allen Applied Research, Inc., Study of the Relative Costs of Ship Construction, Conversion, Alteration, and Repair in Naval and Private Shipyards, June 30, 1972, hereafter referred to as the Booz-Allen Study.

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Table 3-1. (U) NEW CONSTRUCTION SHIP DELIVERIES BY NAVAL SHIPYARDS 1958-1972

UNCLASSIFIED				
YEAR	PHILADELPHIA	PORTSMOUTH	PUGET	MARE ISLAND
1958		1 SSG, 1 SSN		1 SSN
1959		1 SS, 1 SSN		
1960			1 DDG	1 SSGN
1961	2 DDG	1 SSN, 1 SSBN	1 DDG, 1 LPH	1 SSN, 1 SSBN
1962	1 LPH			2 SSN
1963	1 LPH			2 SSBN
1964		1 SSN, 2 SSBN	1 CG, 1 AOE	2 SSBN
1965	1 LPH		1 AS	1 SSBN
1966				1 SSBN
1967		1 SSN	2 CG, 1 AD	
1968			1 AD	1 SSN
1969	1 LPH, 1 LST	1 AGSS, 1 SSN	1 AOE	
1970	2 LST		1 AOE	
1971	1 ICC	1 SSN		2 SSN
1972				2 SSN

Source: (U) Department of Defense Authorization for Appropriations for Fiscal Year 1981, Hearings, Senate Committee on Armed Service, Ninety-sixth Congress, second session, Part 2, p. 1090.

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B. RESULTS OF THE BOOZ-ALLEN STUDY (U)

1. Levels of Comparison(U)

(U) Table 3-2 presents the levels at which shipwork costs were compared and the adjustments made to achieve comparability. In general, there were four levels:

- (U) Shipyard price
- (U) Shipyard price and government furnished materials
- (U) Cost to the Department of Defense
- (U) Cost to the federal government.

(U) The question immediately arises as to which level has the highest degree of comparability. Returning to Table 3-2, note that, at the shipyard and shipyard-plus-GFM levels, the government costs do not include depreciation for yard facilities or disability compensation, whereas these two costs are included in the overhead figures for private shipyards. In government shipyards, depreciation and disability compensation costs are added along with NAVSHIP and military compensation costs to obtain the DoD-level figure. The latter two costs are relatively minor.

(U) Thus, for both government and private yards, the concept of total costs for shipwork in the shipyard is most nearly achieved using the DoD-level figure. Even this level is not strictly comparable, because the government figures exclude the cost of capital (to the federal government), whereas the private shipyard overhead costs include interest payments. However, the differences in interest payments undoubtedly had little effect on the relative costs in the period of the study. The cost to DoD figures are thus reasonably comparable.

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Table 3-2. (U) FOUR LEVELS OF COMPARISON AND ADJUSTMENTS
MADE TO ACHIEVE COMPARABILITY

UNCLASSIFIED		
COMPARISON LEVEL	NAVAL SHIPYARDS	PRIVATE SHIPYARDS
SHIPYARD PRICE	<ul style="list-style-type: none"> • COSTS ADJUSTED FOR PHYSICAL COMPARABILITY • COSTS NORMALIZED TO 1971 DOLLARS • SELECTED GOVERNMENT FURNISHED MATERIAL (ADDED)[†] 	<ul style="list-style-type: none"> • COSTS ADJUSTED FOR PHYSICAL PHYSICAL COMPARABILITY • COSTS NORMALIZED
SHIPYARD PRICE PLUS GOVERNMENT FURNISHED MATERIAL	<ul style="list-style-type: none"> • GOVERNMENT FURNISHED MATERIAL** (ADDED) 	<ul style="list-style-type: none"> • GOVERNMENT FURNISHED MATERIAL** (ADDED)
COST TO DEPARTMENT OF DEFENSE	<ul style="list-style-type: none"> • DEPRECIATION EXPENSES (ADDED) • MILITARY COMPENSATION (ADDED) • DISABILITY COMPENSATION (ADDED) • NAVSHIPS COST (ADDED) 	<ul style="list-style-type: none"> • SUPSHIP COST (ADDED) • DCAA COST (ADDED)*** • NAVSHIPS COST (ADDED)
COST TO FEDERAL	<ul style="list-style-type: none"> • IMPACTED AREA PAYMENTS (ADDED) • COST OF CAPITAL (ADDED) 	<ul style="list-style-type: none"> • FEDERAL INCOME TAXES (DEDUCTED)

(U) [†]Which is equivalent to Contractor Furnished Material (CFM) for other signs in the group.

(U) ^{**}Applicable to all except regular overhaul work and DLG modernizations.

(U) ^{***}Defense Contract Audit Agency.

(U) Source: Booz-Allen Study, op.cit., p. II-13.

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From this point on the cost to DoD figures will be used as the primary basis of comparison.¹

2. Cost Comparisons (U)

a. SSBN-640 Class (U)

(U) The figures in Table 3-3 will help further illustrate the Booz-Allen procedure. The dollar values in the table represent the average dollar cost for the sample of ships in the class. The sample size is provided below the table. In this case, the number of SSBN-640s in the sample was two from a single government shipyard and nine from two private shipyards.²

(U) The figures in the right-hand column indicate the estimated relative costs at the four levels. The figures are obtained by dividing the government shipyard averages by the private shipyard averages. Note that at the DoD level, the average cost for government shipyards was 1.19 times the private shipyard average costs; i.e., 19 percent higher.

(U) The lower half of Table 3-3 shows the percentage distribution of average costs at each level relative to DoD costs. In this case, GFM represented about one-third of total DoD costs. This percentage can be expected to be relatively high for complex submarines and naval combatants and implies that labor-intensive, outfitting-type activities will be

¹(U)It turns out that the same general conclusions are implied regardless of the level of comparison.

²(U)Clearly, the sample size is small, especially for the government shipyards; however, because of very stringent comparability criteria used by Booz-Allen, the quality of the comparisons is very high for the selected sample. This is about all that could be accomplished given the circumstances of data availability and comparability.

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Table 3-3. (U) RELATIVE COSTS OF SSBN-640 CONSTRUCTION*
(Dollar Values in Thousands)

UNCLASSIFIED			
COST LEVEL	GOVERNMENT SHIPYARDS	PRIVATE SHIPYARDS	RATIO OF GOV'T. TO PRIVATE
		AVERAGE DOLLAR VALUE OF SAMPLE	1.29 1.18 1.19 1.24 1.31
Shipyards Price	87,228	67,648	
Plus GPM	<u>42,702</u>	<u>43,002</u>	
Shipyards Price Plus GPM	129,930	110,650	
Plus Adjustments at DoD Level	<u>6,130</u>	<u>3,657</u>	
Cost to DoD	136,060	114,307	
Plus Adjustments at Gov't. Level	<u>2,956</u>	<u>-1,830</u>	
Cost to Government	139,016	112,477	
DoD Cost Less GPM	93,358	71,305	
		PERCENT OF COST TO DOD	
Shipyards Price	64.1	59.2	
GPM	<u>31.4</u>	<u>37.6</u>	
Shipyards Price Plus GPM	95.5	96.8	
Adjustment at DoD Level	4.5	3.2	
Cost to DoD	<u>100.0</u>	<u>100.0</u>	

(U) *Sample size:

	<u>Government</u>	<u>Private</u>
Shipyards	1	2
Ships	2	9

(U) Source: Derived from Booz-Allen Study, op.cit., p. II-24.

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greatest for these types of ships. These are activities which government shipyards are especially equipped to perform.

(U) Again referring to Table 3-3, note that the GFM is virtually the same for both types of shipyards. This is also the case for the other ship classes. To obtain a better idea of the relative costs of actual shipyard activity, GFM costs were subtracted from DoD costs and then compared. For the SSBN-640 class, DoD cost less GFM was 31 percent higher in government shipyards.

b. Summary of Relative Costs (U)

(U) Table 3-4 presents a summary of the relative ship costs for all ship classes examined in the Booz-Allen Study. Several points should be noted:

1. (U) Government costs were higher for all classes of ships, regardless of the level of comparison. At the DoD level, DoD costs at government shipyards were 17 to 79 percent higher than DoD costs at private shipyards.
2. (U) The differences between government and private shipyard costs were smallest when the relative size of GFM was highest. This implies that the greater the complexity of the outfitting requirement, the smaller the differences in cost. Government shipyards are especially equipped for outfitting-type activities.
3. (U) The most comparable measure of relative costs of the shipyard activity is DoD cost less GFM. This ratio ranged from 1.31 to 1.84; i.e., government shipyard costs were 31 to 84 percent higher than private shipyard costs.
4. (U) As will be discussed in the next subsection, the excess of government shipyard costs (DoD costs minus GFM) over private shipyard costs exceeded the relative differences in labor wage rates (roughly 10-17 percent). This implies that government shipyard productivity was lower than private shipyards for all ship classes.

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Table 3-4. (U) SUMMARY OF RELATIVE SHIP COSTS, BY SHIP CLASS

UNCLASSIFIED					
COMPARISON	SHIP CLASS				
	SSBN-640	SSN-637	ULG-26	LPH-26	IST-1179
Ratio of Govt. to Private Costs					
Cost to DoD	1.19	1.53	1.17	1.55	1.79
DoD Cost Less GPM	1.31	1.81	1.36	1.60	1.84
Cost to Government	1.24	1.58	1.21	1.63	1.84
Percent GPM*					
Government Yards	31.4	23.2	44.6	5.4	3.2
Private Yards	37.6	35.4	52.3	8.4	5.8
Ships in Sample					
Government Yards	2	4	3	2	2
Private Yards	9	15	3	2	2

*(U)GPM as a percent of DoD costs.

Source: (U)Tables 3-2 through 3-6.

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3. Factors Causing Relative Cost Differences (U)

(U) The Booz-Allen Study identified the key factors which caused the higher costs in government shipyards. These are listed in Table 3-5, along with an assessment (by Booz-Allen) of the degree of influence on the cost differentials. The factors have been arranged into two classes: (1) those which have a direct influence on costs and (2) those which have a direct influence on productivity. Some reformulation of the Booz-Allen concepts was necessary in order to place the factors into the two classes and to emphasize certain points.

a. Factors Directly Influencing Costs (U)

(U)(1) Higher Compensation and Fringes—During the time-frame used by the Booz-Allen Study (1962-1971), the percent by which government shipyard wage rates exceeded private yard rates ranged from zero percent in 1962 to 17 percent in 1971.¹ The weighted average basic wage per man-hour in the ten government yards increased by about 66 percent, as against an increase of about 42 percent for private yards.

¹(U)Idem, p. II-53. The wage rates are for annual average straight time hours.

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Table 3-5. (U) FACTORS CAUSING HIGHER COSTS IN GOVERNMENT SHIPYARDS

UNCLASSIFIED	
FACTOR	DEGREE INFLUENCE
<p>DIRECT INFLUENCE ON COSTS</p> <ul style="list-style-type: none"> • Higher compensation and fringes • Higher overhead rates • Inflexible reduction in force (RIF) policies* • Rising military pay • Restrictive procurement policies <p>DIRECT INFLUENCE ON PRODUCTIVITY</p> <ul style="list-style-type: none"> • Disruption for higher priority requirements <ul style="list-style-type: none"> • Emergent higher priority repair work • Generally higher priority repair work • Special conditions* 	<p>Major Major Significant Minor Minor</p> <p>Significant</p> <p>Minor</p>

(u) *Departure from the Booz-Allen Study wording or concepts.
 (u) Source: Derived from Booz-Allen Study, op.cit., p. II-63.

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(U) At the time of the study, ungraded shipyard workers in government yards (wage-board employees) were paid on an hourly scale set according to law on the basis of an annual review of the prevailing wage for similar trades within the geographic area of the shipyard. As will be discussed in greater detail in a subsequent section, the procedure for establishing the rates typically resulted in higher wages paid to government shipyard employees than for employees with similar jobs in private yards.

(U) Similarly, salary scales for graded (GS-rated) government shipyard employees increased an average of 85 percent during the ten-year period, while salaries for their counterparts in private yards increased only 35 to 45 percent.¹

(U)"...This escalation contributed, along with other factors, to a Naval shipyard overhead (indirect) labor cost which was approximately 15 to 25 percent higher than that of the private shipyards as of the end of fiscal year 1971..."²

(U) Fringe benefits in government yards were also apparently higher, although widely varying practices among private shipyards precluded direct comparisons. Government shipyards apparently provided:

- (U) More liberal sick leave policies
- (U) More paid holidays
- (U) Longer vacations, particularly for long-service employees.

¹(U)Idem, p. II-52.

²(U)Idem, pp. II-53, 54.

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(U) (2) Higher Overhead Rates—Although differing accounting practices prevented direct comparisons of overhead rates, the Booz-Allen Study concluded that the evidence pointed to much higher rates in government yards. In particular:

(U)"...Naval shipyards normally employ larger numbers of people for such functions as engineering, planning and estimating, comptroller, material management, etc., than do the private yards visited where individual personal accountability was more often stressed. Maintenance of larger, more elaborate facilities is also a factor in higher overhead; considerable fully ready, but under-utilized capacity was apparent in most Naval shipyards. The more complex and numerous management systems employed by Naval shipyards are also considered to contribute to the differences noted. These and various collateral programs conducted are reflected both in the organizational structure of Naval shipyards and in substantial numbers of relatively high-grade positions which have not contracted in proportion to the decline in workload."¹

(U) (3) Inflexible RIF Policies—The study did not provide specific evidence that inflexibility in terminating government employees actually caused higher government costs during the study period. However, the following statement indicates that the problem was significant:

(U)"Civil Service Reduction in Force (RIF) policies and procedures at Naval shipyards require a considerable length of time (at least 90 days, and generally longer) to effect any significant manning level decreases. The time lag between the initiation and the accomplishment of force reductions during periods of decreasing workload has resulted in depreciable chronic over-manning and sometimes trade imbalances in both direct and indirect civilian employee categories, particularly during 1969-1971. Private shipyard force reduction practices permit much quicker response to workload fluctuations with

¹(U)Idem, p. II-56.

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THE REINSTITUTION OF THE CONSTRUCTION OF US NAVY
COMBATANT SHIPS IN US GO. (U) INSTITUTE FOR DEFENSE
ANALYSES ALEXANDRIA VA PROGRAM ANALYSIS.
J N FRY ET AL. JAN 82 IDA-5-538 F/G 13/

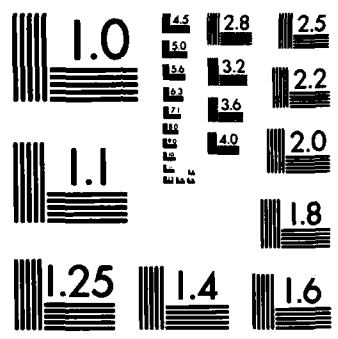
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initiation-to-accomplishment times of two hours to two days in most cases, as compared to 90 days or more in Naval shipyards (emphasis added).

Termination pay allowance policies for Naval shipyard employees involved in a RIF are significantly more generous than those of private shipyards. Some private shipyards do not provide any such allowance for direct production employees and only nominal allowances for supervisory, professional, and management personnel who are laid off. Also, the wage/salary retention policy applicable to Naval shipyard personnel who accept a RIF-associated demotion further increases the relative "cost of RIF" differential between the Naval and private sectors."¹

(U) (4) Other Factors—Rising military pay and restrictive procurement practices were regarded in the Booz-Allen Study as making minor contributions to higher government costs; therefore they will not be discussed here except to point out that the latter has the potential for causing substantial cost increases.² The government requirement to award a contract to the "lowest bidder" can be a time-consuming process. Savings in actual prices paid can easily be offset by costs of production delays.

b. Factors Directly Influencing Productivity (U)

(U) (1) Disruptive Effects of Higher Priority Repairs—The higher costs in the government shipyards cannot be entirely explained by differences in wage rates, overhead, etc. There were also substantial differences in productivity, and these differences were primarily caused by the Navy's policy of placing higher priorities on repair and overhaul

¹(U)Ibid, pp. II-56 and II-57.

²(U)Ibid.

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work. Under this policy, construction work may be interrupted or slowed down if

- (U) emergent (emergency) repairs must be accomplished, or
- (U) generally higher priority (than ship construction) repair work must be accomplished.

The distinction between the two situations is that the first relates directly to the current effectiveness of naval forces, whereas the second relates to the programmed effectiveness of the fleet. In the latter case, if the repairs are not accomplished within the scheduled time, then fleet effectiveness may be less than planned and the remaining repairs given top priority. Repair and overhaul schedules could also be accelerated and given higher priority if demands on the fleet are accelerated; e.g., under tense international conditions.

(U) The Booz-Allen Study concluded that:

(U)"...The disruptive effects of emergent high-priority Fleet requirements on new construction conversion and regular overhaul work have had significant adverse effect on Naval shipyard costs. During the period July 1964 through December 1966, which falls within the period examined by this study, approximately 7,900 man-years...of Naval shipyard production labor were diverted from regularly scheduled work, primarily shipbuilding, to non-scheduled urgent priority work requirements generated by the Vietnam situation. Such priority-related disruptions were relatively negligible in the private sector. The majority of such work could be assigned immediately to the Naval sector, which had available facility capacity, without the negotiation or prior contractual arrangements required for private sector work award. The mission requirement to service these demands and absorb their disruptive consequences upon regularly scheduled workload is an inherent characteristic of the Naval shipyard complex. The consequences are manifested principally by the elements described below:

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- (U) Productive time lost by production personnel resulting from more frequent work site reassignments from one ship to another.
- (U) Productivity losses caused by degradation of an individual's learning benefits resulting from relatively frequent changes in work assignments among different types of ships.
- (U) Schedule degradation resulting from necessary unplanned diversion of manpower from a ship which causes delays in its completion.

The aggregate effect of these elements, in addition to directly increasing labor costs, is to lengthen the construction or overhaul period. This, in turn, generates other labor and material costs for time-related service functions...."¹

(U) The SSBN-640 construction program, however, is a case where disruption was not a factor. The SSBNs were

(U)"...given very high priority in all the shipyards involved so that they had the benefit of more management attention and were not affected in the Naval shipyard by disruption from higher priority in work.

Their design, procurement, construction, quality control, and testing requirements were unusually well-defined, standardized and centrally enforced with the result that the yards in both sectors were affected equally by the benefits and constraints of the disciplined program. This condition undoubtedly damped out many of the [negative] relative performance variables which might otherwise have existed...."²

(U) The consequence of these special conditions was that for SSBNs the ratios of government shipyard costs to private shipyard costs were substantially lower than for other ships (see Table 3-4).

¹(U)Idem, pp. 58-59.

²(U)Idem, p. II-61.

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(U) (2) Other Factors—Certain other factors which occurred at the time of the construction program had a negative effect on productivity at government shipyards. These involved the disruptive effects of actual shipyard closures and plans to close a certain government yard. They were regarded as having a minor impact on relative costs.

(U) (3) Summary—The following statement in the Booz-Allen Study provides a good summary of why government shipyards had lower ship construction productivity than private yards:

(U)"In a sense, the reason for being of the Naval shipyard complex gives rise to a set of circumstances contributing to [lower productivity and, therefore,] higher cost. These yards are a vital adjunct to the operating forces of the Navy and are expected to provide positive response to emergency requirements, high-priority shipwork assignments, and sudden changes in schedule to accomodate operational needs. Frequent rescheduling and disruption of work necessarily result, so that routine work is delayed and its cost increased. A related factor is the necessity to maintain a more comprehensive range of active capabilities than a private yard would find profitable."

C. THE CURRENT SITUATION (U)

(U) At this point it should be recalled that only five shipyards are regarded as candidates for nuclear ship construction. These yards are

¹(U)Ibid.

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<u>Shipyard</u>	<u>Nuclear Ship Type</u>
Government	
Puget Sound	CGN-42, CGN-38C, SSN-688
Mare Island	SSN-688 only
Portsmouth	SSN-688 only
Private	
Newport News	CVN, CGN-42, CGN-38C, SSN-688
Electric Boat	SSBN, SSN-688

For this reason, the focus of the subsequent analysis will be on the situation at these shipyards.

1. Wage Rate Determination at Government Shipyards¹ (U)

(U) Civilian employees in government shipyards are divided into two groups:

- (U) Wage-grade employees (trade, labor and craft job classifications),
- (U) General schedule employees (administrative, clerical technical and professional classifications).

Pay rates for the general schedule employees come under a single national rate schedule, the GS schedule. There are no regional differences except under special circumstances. In contrast, pay rates for the wage-grade employees are based on wages for similar occupations in local labor market areas; therefore, regional differences can, and do, exist between government shipyards.

(U) The structure for non-supervisory wage-grade employees in government shipyards is as follows:

¹(U)See Reference [3], Appendix O for a thorough discussion of the federal wage system.

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<u>Occupation</u>	<u>Grade Spread</u>
Journeymen	WG-9 through WG-15
Helpers	WG-5
Other	WG-1 through 15

Regular leaders and supervisors are paid on corresponding WL and WS schedules.

(U) All grades have five within-grade pay levels (steps). The pay rate for each successive level is four percent higher than the preceding level. Advancement to the next highest step is automatic if work performance is satisfactory. The advancement periods for each wage-grade and step are:

<u>Step</u>	<u>Advancement Period (Years)</u>	
	<u>WG and WL</u>	<u>WS</u>
1	1/2	1
2	1 1/2	1
3	2	2
4	2	2

Note that it takes six years to reach step 5, regardless of the grade.

(U) In general, leader grades (WL) are set at 10 percent above the non-supervisory grades. Supervisory grades (WS) 1 through 10 are 30 percent higher than non-supervisory rates. Grades WS-11 and above are based on a parabolic curve linked at the top to the GS-14 rate.

(U) The analysis in the following subsection considers only relative differences in the non-supervisory rates, but it should be noted that the relative differences between government shipyards are the same for supervisory and leader grades as for the non-supervisory grades. In the subsequent analyses, the WG-11, step 13 pay rate has been arbitrarily

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assigned as the median wage rate for journeymen. This probably understates the actual median at government shipyards, because the journeyman experience level is very high at all three yards.

2. Factors Directly Influencing Costs (U)

a. Wage Rate Differentials (U)---A point that the Booz-Allen Study overlooked or at least did not emphasize is the substantial regional difference in shipbuilding occupational wage rates. This may have been the main cause for the higher costs in government shipyards. In any case, under current conditions, a ship constructed on the Pacific Coast by either a private or government shipyard would cost substantially more than one built on the Atlantic Coast simply because wage rates are much higher on the Pacific Coast.

(U) Table 3-6 shows the regional hourly wage-rate differentials for private shipyards. The percent differences between the Pacific Coast and Atlantic Coast median rates are:

<u>Occupation</u>	<u>Percent Difference</u>
Loftsman	+34
Mechanic	+36
Helpers	+50
Trainees	+20

There are, of course, no current candidate private shipyards for nuclear ship construction on the Pacific Coast. The two private yards that are currently constructing nuclear ships happen to be located in the lower wage rate areas on the Atlantic Coast.

(U) Because government shipyard hourly wage-rates are directly related to the wage rates paid in their respective

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Table 3-6. (U) HOURLY WAGE RATES PAID IN PRIVATE SHIPYARDS, BY OCCUPATION, PACIFIC COAST VERSUS ATLANTIC COAST

(Latest Effective Date of Union Agreement)

UNCLASSIFIED				
Occupation	Pacific Coast	Atlantic Coast	Ratio of Pacific Coast to Atlantic Coast	Percent Difference
JOURNEYMEN				
<u>Loftsmen</u>				
Highest	12.22	10.33	1.18	+18
Lowest	9.67	8.55	1.13	+13
Median	12.16	9.08	1.34	+34
<u>Mechanic</u>				
Highest	11.97	9.76	1.23	+23
Lowest	8.71	8.12	1.07	+7
Median	11.91	8.77	1.36	+36
HELPERS AND LABORERS				
<u>Helpers</u>				
Highest	11.87	9.18	1.29	+29
Lowest	7.94	5.55	1.43	+43
Median	11.63	7.77	1.50	+50
<u>Laborers</u>				
Highest	11.87	9.06	1.31	+31
Lowest	8.00	5.28	1.52	+52
Median	11.63	7.80	1.49	+49
<u>Trainees</u>				
Highest	9.50	8.61	1.10	+10
Lowest	7.14	6.16	1.16	+16
Median	8.00	6.66	1.20	+20

(U)Source: Derived from Shipbuilders Council of America, Basic Wage Rates and Fringe Benefits Survey (updated to October 1981).

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labor market areas, regional differences also exist between government shipyards (see Table 3-7). The median wage rate (WG-11, step 13) differentials are summarized below:

<u>Occupation</u>	<u>Percent Difference</u>	
	<u>Seattle to Atlantic Coast</u>	<u>San Francisco to Atlantic Coast</u>
Journeyman	+19	+30
Helpers	+32	+24
All Other	+35	+35

Thus, Puget Sound must pay a journeyman an average of 19 percent more than Portsmouth; Mare Island must pay a journeyman an average of 30 percent more than Portsmouth.

(U) Now consider the differences between the candidate government and private shipyards (Table 3-8 and Figure 3-1). The median wage rate for a journeyman at Puget Sound Naval Shipyard in Seattle is 19 percent more than the median rate paid for a loftsmen in a private shipyard on the Atlantic Coast and 24 percent more for a mechanic. The median journeyman rate at Mare Island is 30 percent more than the loftsmen rate and 35 percent more than the mechanic rate. Note further that the differences between Portsmouth and the private yards are relatively minor. This is because the Atlantic Coast labor market area survey from which the Portsmouth rates were determined includes the Electric Boat and Newport News areas.¹

(U) Figure 3-1 shows that the range of wage rates for private shipyards on the Atlantic Coast is generally below

¹(U) Portsmouth actually has slightly higher wage rates than indicated in the official schedule, but the differences are minor. The official schedule was used in order to maintain comparability.

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Table 3-7. (U) HOURLY WAGE RATES PAID TO CIVILIAN EMPLOYEES IN GOVERNMENT SHIPYARDS IN SEATTLE, SAN FRANCISCO, AND ATLANTIC COAST AREAS, BY OCCUPATION

Occupation	Seattle Area	San Francisco Area ²	Atlantic Coast ³	UNCLASSIFIED			Percent Difference	
				Ratio		S.P. to Atlantic Coast	Seattle to Atlantic Coast	S.P. to Atlantic Coast
				Seattle to Atlantic Coast	S.P. to Atlantic Coast			
Journeyman								
Highest (MO-15, Step 5)	13.01	14.69	11.44	1.14	1.28		+14	+28
Lowest (MO-9, Step 1)	9.44	10.10	7.69	1.23	1.33		+23	+33
Median (MO-11, Step 3)	10.85	11.84	9.10	1.19	1.30		+19	+30
Helpers								
Highest (MO-5, Step 5)	9.68	9.87	7.34	1.32	1.34		+34	+34
Lowest (MO-5, Step 1)	8.29	9.16	6.29	1.32	1.46		+32	+46
Median (MO-5, Step 3)	8.99	8.46	6.81	1.32	1.24		+32	+24
All Other								
Highest (MO-8, Step 5)	10.68	11.30	8.57	1.25	1.32		+25	+32
Lowest (MO-1, Step 1)	7.14	6.81	4.90	1.46	1.39		+46	+39
Median (MO-4, Step 3)	8.67	8.70	6.44	1.35	1.35		+35	+35

(U) ¹Effective 16 November 1980.

(U) ²Effective 16 November 1980.

(U) ³Effective 9 August 1981.

(U) Source: Department of Defense Wage Fixing Authority.

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Table 3-8. (U) COMPARISON OF MEDIAN HOURLY WAGE RATES IN
GOVERNMENT SHIPYARD VERSUS PRIVATE ATLANTIC COAST
YARDS

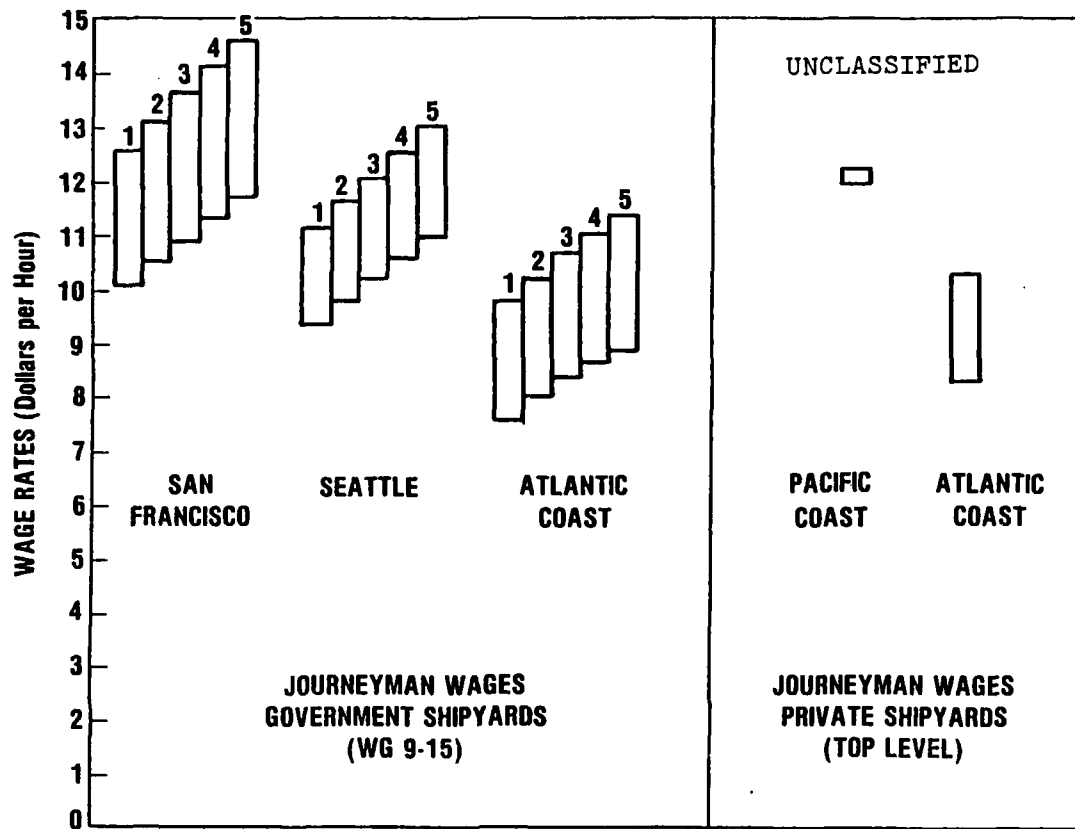
UNCLASSIFIED						
Occupation	Median Wage Rate*				Percent Difference of Government Yards from Private Yards	
	Seattle	S.F.	Atlantic	Private Atlantic Coast	Seattle	S.F.
Journeyman	10.85	11.84	9.10	9.08	+19	+30
Loftman				8.77	+24	+35
Mechanics				7.77	+16	+9
Helpers	8.99	8.46	6.81			
						0 +4 -12

* (U) CG-11, step 3 for government yards.

(U) Source: See Tables 3-6 and 3-7.

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Source: (U) Tables 3-6, 3-7.

Figure 3-1. (U) CURRENT JOURNEYMAN WAGE RATES
IN GOVERNMENT AND PRIVATE SHIPYARDS

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the journeyman wage-rate structure at the Pacific Coast government shipyards. The highest loftsmen wage rate at the Atlantic private yards barely touches the lower levels at San Francisco (Mare Island).

(U) Thus, assuming equal productivity levels at government versus private shipyards, the Atlantic Coast private shipyards have a distinct direct labor cost advantage over government shipyards on the Pacific Coast but only a minor advantage over Portsmouth.

b. Fringe Benefits (U)--Time did not permit a thorough analysis of fringe benefits, but a cursory examination indicates that government shipyard fringes are superior to and cost more than private fringes, particularly with respect to vacation time and sick leave policies. This implies that the total labor cost per hour differentials between Pacific Coast government shipyards and Atlantic Coast private shipyards are greater in relative terms than for wage-rates alone.

c. Overhead Rates (U)--There is simply no accurate way to compare overhead rates between government shipyards performing overhaul and repair and private shipyards performing new construction. The study team's general observations during visits to government and private shipyards tend to confirm the Booz-Allen Study conclusion (see Page 3-16) that

(U)"...Naval shipyards normally employ larger numbers of people for such functions as engineering, planning and estimating, comptroller, material management, etc., than do the private yards...."

Moreover, private shipyards have an automatic incentive to minimize overhead which government shipyards do not have, i.e.

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profit. Thus, it would be expected that government overhead rates would be at best as high as private shipyard rates.

d. Inflexible RIF Policies (U)--In the specific case of construction of nuclear ships by the five candidate shipyards, reduction in force (RIF) policies would not be a factor with respect to relative costs. Unless unforeseen events occur, the two private shipyards are likely to be actively recruiting labor for many years to come, not laying off workers because of reduced Navy orders.

e. Materials and Equipment Procurement Policies (U)--Several private shipyard officials cautioned the study team that government procurement procedures are not geared to the realities of supplier conditions. From the suppliers viewpoint, the orders for the items needed in shipbuilding are typically very small relative to those of alternative buyers. Therefore, such suppliers are relatively indifferent to the needs of the shipyards. Accordingly, special relationships and guarantees need to be developed to assure an adequate and timely supply of materials and equipment.

(U) Timeliness is especially important. Production delays due to late arrival of materials and equipment can be very costly. The typical government procurement procedures, private shipbuilders warn, are too inflexible to assure that such delays will not occur.

(U) Officials at the three government shipyards agree that they could not procure materials and equipment for a ship construction program without unrestricted purchasing authority and a class determination and findings to permit negotiated

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procurements¹. In addition, they have proposed using a cooperative arrangement with Electric Boat and Newport News to purchase common items so that suppliers would perceive a larger order and adjust production schedules accordingly.

(U) Thus, government shipyards are likely to experience relatively higher materials and equipment costs unless government procurement policies are adapted to the needs of the construction program.

3. Factors Influencing Productivity (U)

(U) Productivity levels are not necessarily the same among shipyards, so that regional differences in wage rates could be partly compensated for by higher productivity. Evidence of this appears in the overhaul and repair costs in government yards.

a. Overhaul and Repair Costs on Government Shipyards (U)

Figure 3-2 and Table 3-9 show that in spite of the fact that Puget Sound has had much higher wage rates than Portsmouth, its overhaul and repair manday rate has typically been lower. Mare Island, on the other hand, has never reached the Portsmouth levels for manday rates.

(U) Clearly, differences in work assignments can have an important bearing on manday rates. Puget Sound has always had more surface ship work than either Mare Island or Portsmouth, where submarine work has been dominant. A comparison of Puget Sound and Norfolk, which have had similar work assignments, indicates that Puget Sound had lower rates than

¹(U)Reference [2], page 44. Portsmouth currently has this authority, Puget Sound and Mare Island do not.

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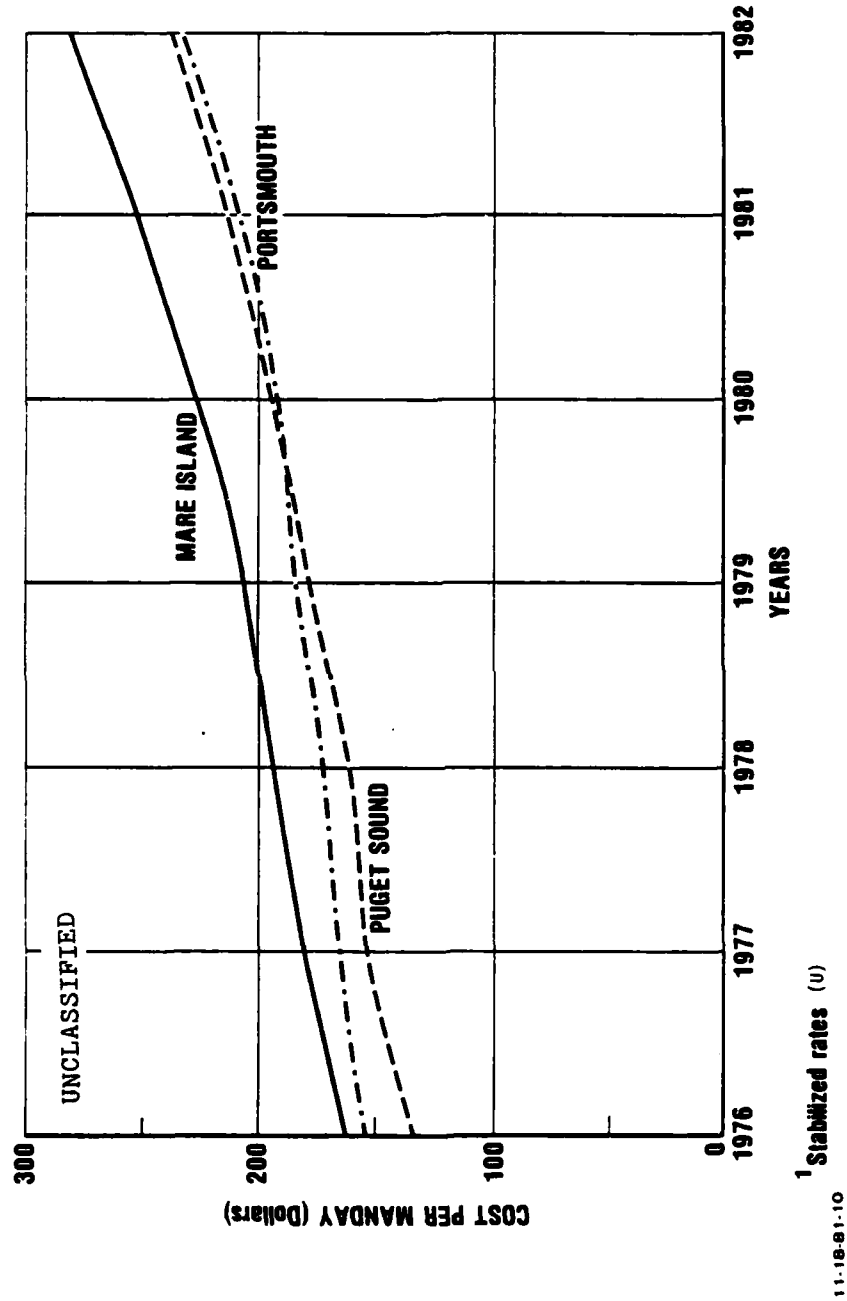


Figure 3-2. (U) COST PER OVERHAUL AND REPAIR MANDAY¹ AT MARE ISLAND, PUGET SOUND AND PORTSMOUTH

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Table 3-9. (U) COST PER OVERHAUL AND REPAIR MANDAY IN SELECTED NAVAL SHIPYARDS
(Stabilized Rates in Dollars)

Fiscal Year	UNCLASSIFIED						
	Mare Island	Puget Sound	Portsmouth	Norfolk	Charleston	Long Beach	Philadelphia
1976	161.52	137.27	153.52	142.24	161.28	143.28	148.24
1977	180.16	152.36	166.72	161.65	182.56	157.69	161.36
1978	192.16	161.20	171.76	176.76	188.16	175.68	169.52
1979	205.90	179.92	181.74	178.86	203.40	189.18	194.30
1980	225.84	194.56	190.32	184.24	206.96	203.28	194.48
1981	250.72	213.20	209.04	206.48	212.00	223.92	211.28
1982	280.32	238.72	237.20	228.08	246.48	254.32	232.24

(U) Source: NAVSEA.

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Norfolk from 1976 to 1978, but slightly higher rates after 1978. Except for 1981, Puget Sound has always had lower rates than Charleston.

(U) Table 3-10 shows the ranking of manday rates in 1981 and 1982. Note that the 1982 Puget Sound figures are projected to be roughly competitive with the Atlantic Coast government shipyards. The spread between Puget and Norfolk is less than five percent, i.e. far less than the wage rate differential.

Table 3-10. (U) RANKING OF GOVERNMENT SHIPYARD MANDAY RATES, 1981 AND 1982

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Government Shipyard	Cost Per Manday		Ranking	
	1981	1982	1981	1982
PACIFIC COAST YARDS				
Mare Island	250.72	280.32	1	1
Long Beach	223.92	254.32	2	2
Puget Sound	213.20	238.72	3	4
ATLANTIC COAST YARDS				
Charleston	212.00	246.48	4	3
Philadelphia	211.28	232.24	5	6
Portsmouth	209.04	237.20	6	5
Norfolk	206.48	228.08	7	7
MEDIAN	212.00	238.72		

(U) Finally, Table 3-11 makes direct comparisons between the three candidate government shipyards with respect to median journeyman wage rates (WG-11, Step 3) and manday rates in 1981. Mare Island is clearly the highest cost yard. Note

UNCLASSIFIED**Table 3-11. (U) SUMMARY OF GOVERNMENT SHIPYARD COST COMPARISONS**

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Comparison	1981 Percent Difference
<u>Mare Island To Portsmouth</u>	
Median journeyman rate	+30.1
Stabilized manday rate	+19.9
<u>Mare Island to Puget Sound</u>	
Median journeyman rate	+9.1
Stabilized manday rate	+17.6
<u>Puget Sound to Portsmouth</u>	
Median journeyman rate	+19.2
Stabilized manday rate	+2.0

that some of the wage differential between Mare Island and Portsmouth has been reduced in the manday rates, but this is not the case with respect to Mare Island versus Puget Sound. Note further that in spite of a 19 percent higher wage rate, the Puget Sound manday rate is only two percent higher than the Portsmouth rate.

(U) Although the differences in manday rates can be partly attributed to differences in work assignments, the figures presented above are consistent with the quantity and quality of facilities at the three shipyards. Puget Sound has the most extensive and modern plant; Mare Island facilities

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are less modern and extensive, and Portsmouth ranks last in this respect.¹

(U) Whether or not these same productivity differences could be extended to nuclear ship construction is still an open question, but the overhaul and repair record points to Puget Sound as the most logical choice on productivity grounds.

b. Disruptive Effects of Higher Priority Repairs (U)

(U) All three government shipyards are needed for overhaul and repair of the existing fleet. Any ship construction effort would be in addition to the overhaul and repair work load. Therefore, the potential would exist that higher priority repairs, e.g. emergency repairs, could disrupt new construction. Incidentally, Newport News also is likely to have a heavy overhaul and repair load, so the potential would exist there, also.

(U) The study team discussed this matter thoroughly during the visits to the shipyards and it was generally agreed that the new construction effort must be separated from the overhaul and repair activity through both physical separation of facilities (where practical) and separation or redundancy of management functions. The latter will be most difficult in the government shipyards, because the emphasis always has been

¹(U)A new machine shop is currently under construction at Portsmouth, so the facilities gap is closing somewhat. The submarine building ways, however, need major rehabilitation.

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on maximizing the readiness of the existing fleet.¹ Any shipyard commander would find it difficult not to use all available resources (including construction for emergent repair) if conditions warranted such an action.

(U) Officials in all three government shipyards agreed that the construction effort would have to be separated as much as possible and that a commitment must be made to minimize the disruption of the construction effort. In other words, a commitment much like that of the SSBN program in the 1960s would be desirable. Otherwise, the same conditions experienced during the 1960s could prevail. There is little reason to assume that international conditions as serious as the Vietnam conflict could not develop in future years.

4. Estimated Productivity Levels (U)

a. SSN-688 Production (U)--Table 3-12 presents projections of SSN-688 production mandays provided by the three government shipyards in their individual proposals for producing at a rate of one submarine per year. These are

¹(U)"In comparing repair and new construction methods in navy yards, full consideration must be given to the fundamental fact that a navy yard's primary mission is the "repair and upkeep" of the fleet. Navy yards were established originally for this basic mission, and it affects every action taken within the yard. New construction in a navy yard is actually an activity superimposed on the repair mission and, as far as a navy yard is concerned, its greatest value is its stabilizing effect on the working force, which permits the smoothing out of hollows in the repair load." F.G. Crisp, RADM U.S.N., "Navy Yards," in The Shipbuilding Business in the United States of America, Volume II, F.G. Fassett, Jr., ed, 1948, p. 224.

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Table 3-12. (U) PROJECTED SSN-688 DIRECT LABOR PRODUCTION
MANDAYS--GOVERNMENT VERSUS PRIVATE SHIPYARDS

UNCLASSIFIED				
Shipyard	Production Mandays (000)			
	Government Yard		Private Yard	
	First Ship	4th Ship	Attained	Projected
Puget Sound	900	670		
Mare Island	962	670-700		
Portsmouth	1,200	N.A.		
Electric Boat			699	825
Newport News			526	624

Source: (U)U.S. Navy Shipyard Reports, NAVSEA sources.

compared with attained and projected levels at Electric Boat and Newport News.¹ Note that by the fourth ship, both Puget Sound and Mare Island expect to reach the attained level of Electric Boat, but they would have to improve substantially to reach the attained or projected levels of Newport News.²

(U) Of course, any of the government yards could acquire the latest submarine construction technology and ultimately reach the manhour levels of the private shipyards. In fact, all three government shipyards have proposed the acquisition of ship lift and transfer facilities similar to those at

¹(U)The attained private shipyard figures appeared in the Puget Sound report. Information was not sufficient for an estimate of Portsmouth's fourth ship.

²(U)The Electric Boat projected level reflects 1981 experience.

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Electric Boat-Groton. The Mare Island and Portsmouth shipyards have also proposed the purchase of cylinders from Quonset Point.

(U) The cost of acquiring these facilities appears in Table 3-13, stated as the "cost effective" facilities given in the second column. Each estimate includes a ship lift and transfer system similar to that at Electric Boat, as well as additional land level facilities needed for adoption of the Electric Boat assembly technology.¹

Table 3-13. (U) ESTIMATED ADDITIONAL FACILITIES COSTS FOR THE SSN-688 PROGRAM

(Millions of FY 1982 Dollars)

UNCLASSIFIED		
Shipyard	Mandatory Facilities ¹	Cost Effective Facilities ²
Puget Sound	36	89
Mare Island	37	145
Portsmouth	46	234

¹(U)For conventional shipbuilding methods.

²(U)Includes land level facilities and ship lift and transfer systems.

Source: (U)NAVSEA Reports.

b. Nuclear Surface Ship Production (U)--Puget Sound appears to be the only government shipyard that is a reasonable candidate for nuclear surface ship construction. With the exception of the need for more extensive pre-

¹(U)This technology is regarded as probably the best, irrespective of Electric Boat's current SSN-688 performance which is influenced by the Trident program.

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fabricating facilities and heavier crane lift capacity, the yard's facilities for producing nuclear cruisers are on a par with Newport News. There is no reason to assume, therefore, that Puget Sound could not achieve productivity parity with Newport News except, perhaps, in CVN production where the heavier crane capacity and prefabrication capabilities at the latter's North Yard probably would give the advantage to the private yard.

D. SUMMARY (U)

(U) If Puget Sound and/or Mare Island were located on the Atlantic Coast, there would be a possibility for rough equivalence in ship construction costs, because both government yards already have, or can acquire, the same technology as the two private shipyards and could achieve approximately the same productivity levels at the same resource prices. But the fact is that the two government shipyards are both located in very high labor cost areas. Even if they were to achieve productivity equivalence, the direct labor cost would be roughly 19 percent higher at Puget Sound and 30 percent higher at Mare Island.

(U) For SSN-688 production, the achievement of the productivity levels of Electric Boat or Newport News would require new facilities investments of 89-234 million dollars. The latter figure is for Portsmouth which, because it is located on the Atlantic Coast, would be the only government yard having the opportunity to reach labor cost parity. However, in addition to the facilities costs, labor acquisition and training costs in this yard would be very high, as reflected in the manday estimates for the first ship (see Table 3-12).

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(U) For nuclear surface ships, Puget Sound is the only government shipyard which has the potential of achieving the productivity levels of Newport News. The latter probably has the advantage with respect to CVNs, but not necessarily for nuclear cruisers when the total load upon its facilities is considered. However, Puget Sound would still have at least a 19 percent labor cost disadvantage compared to Newport News.

(U) The achievement of productivity parity is not only a matter of hardware technology, it is also a matter of resource management technology. The Navy's primary overhaul and repair mission would have the potential of interfering with the construction mission through resource management policies that would have to favor emergent overhaul and repair. There is clear evidence that this, in fact, did occur in the 1960s. Government shipyard officials are fully aware of this possibility and all three shipyards have recommended plans that would mitigate interference between the two functions. Whether or not this can occur in practice is an issue that can only be resolved by additional experience. It is generally agreed that failure to achieve a high degree of dedication to the construction mission can only lead to higher adverse construction cost differentials than are already present due to differences in regional wage rates.

(U) Relative cost is only one factor in any decision to reinstitute construction in government shipyards. The next chapter explores other factors which deserve serious consideration.

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Chapter IV

INTRINSIC BENEFITS OF NUCLEAR SHIP CONSTRUCTION IN GOVERNMENT SHIPYARDS (U)

(U) In addition to considering relative costs, the study was directed to examine the intrinsic benefits of naval ship construction in government shipyards. For the purposes of this discussion, "intrinsic" benefits are defined as those effects of constructing ships in government yards that might contribute to national security in ways other than saving resources in the short run.

(U) These effects can be classified into three categories:

- A. (U) Maintenance and development of new construction capabilities
- B. (U) Production and price assurance
- C. (U) Availability of nuclear facilities and processes.

The nature of these benefits is discussed below. A discussion of alternative ways to obtain some of the benefits concludes the chapter.

A. MAINTENANCE AND DEVELOPMENT OF NEW CONSTRUCTION CAPABILITIES (U)

(U) Officials at all three government shipyards visited by the study team expressed concern that, if they do not receive nuclear ship construction projects soon, they will be unable to maintain adequate new ship construction capabilities. It has been almost ten years since any government shipyard has engaged in new construction. All three yards have adjusted their work forces to overhaul and

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repair operations. Generally, this means that the work forces have a heavy emphasis on repair trades (e.g. machinists, electricians, pipefitters) rather than new construction trades (e.g. shipfitters, welders).¹ More importantly, the number of supervisors with ship construction experience has gradually decreased and will continue to decrease if the government shipyards do not receive construction projects soon.

(U) This is the basic issue: Is it essential to national security to maintain a construction capability in certain government shipyards? Traditionally (prior to World War II), it was Navy policy to build the lead ship of a series in a government shipyard. Some of the advantages of this policy have been stated as follows:²

1. (U) The Navy can maintain a design and production engineering capability based on its own experience with ship construction rather than that of a private shipyard. Accordingly, it could maintain an understanding of industrial procedures and functions that could improve the shipbuilding process.
2. (U) The Navy could obtain, first hand, better estimates of mandays required to perform shipbuilding projects.
3. (U) Design changes as a result of first hand experience with the lead ship could be incorporated in follow ship specifications. This would minimize the problem of private builder claims of cost escalation due to Navy design changes.
4. (U) The Navy could improve its research and development capabilities in industrial procedures for new ship construction.

¹(U)See Reference [4], pp. 87-106 for a thorough discussion of the differences in work forces.

²(U)Reference [4], pp. 414-416.

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(U) Tersely stated, new ship construction in Navy shipyards, particularly the lead ship, would provide an independent source of information that could be used in follow ship contract negotiations with private shipyards. In addition, the information would provide a basis for improved R&D in shipbuilding procedures. But, as will be discussed later, a positive answer to the question of construction capability is not equivalent to a decision to institute construction.

B. PRODUCTION AND PRICE ASSURANCE (U)

(U) Because there are currently only two builders of nuclear submarines (Electric Boat and Newport News) and only one builder of nuclear surface ships (Newport News), nuclear ship delivery schedules are highly vulnerable to the problems which these two builders may encounter; e.g., technical difficulties, work stoppages, contract disputes, etc. The disputatious history of the late 1970s, with astronomical contract claims, allegations of fraud, threats to withdraw from government contracting and final White House intervention to settle disputes, is still fresh in the memory of Navy officials and private executives. This suggests that the reinstitution of nuclear ship construction in government shipyards would

1. (U) Reduce nuclear shipbuilding capacity uncertainties,
2. (U) Reduce nuclear ship delivery uncertainties,
3. (U) Increase nuclear shipbuilding surge capacity,
4. (U) Increase competition (control prices).

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1. Reduce Nuclear Shipbuilding Capacity Uncertainties (U)

SSN Production-- (U) It should be recalled that Electric Boat is the sole source producer of Trident submarines. This is the shipyard's primary mission and it has developed special processes to construct this ship type. Similarly, Newport News is the sole source contractor to produce nuclear aircraft carriers and probably nuclear cruisers, and this is its primary mission. Moreover, the fact that these are highly complex ship systems and that workloads for these ships will increase implies that production problems could easily develop.

(U) The Navy's main current concern is the effect that disruptions of these primary programs will have on SSN production capacity. If production in the Trident or CVN/CGN programs is expanded or delayed for any reason, the SSN program is likely to suffer. It is argued that additional active capacity in government yards is needed to offset these uncertainties. Theoretically, at least, a quick-reaction capability would also suffice.

2. Reduce Nuclear Ship Delivery Uncertainties (U)

(U) Aside from the question of adequate physical capacity, the actual performance record of the two private shipyards has increased the Navy's uncertainty as to whether ships will be delivered on schedule. Electric Boat's Trident submarines are currently running about 33 months behind schedule and this has seriously affected the SSN delivery schedule. The Navy is reluctant to award any further SSNs to Electric Boat until the delivery schedule of the current backlog is improved.

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(U) The reasons cited for the delivery delays are:

- (U) Shortages of skilled personnel
- (U) Technical difficulties with the shipbuilding process
- (U) Management deficiencies.

Both firms also threatened to stop existing Navy work because of contract difficulties relating to over-contract cost claims. In addition, in the past they have threatened to withdraw from bidding on future contracts unless certain contract conditions are met. This, of course, adds to the Navy's uncertainty with respect to future deliveries because it has no alternative private contractors with which to do business. The option of building in government yards, or expanding the rate if building is already under way, would reduce this uncertainty.

3. Increase Nuclear Shipbuilding Surge Capacity (U)

(U) If the Navy's assessment of current nuclear submarine and surface ship capacities is correct, there is no excess capacity with which to respond to any relatively immediate requirements. For example, if a decision were made to shorten the delivery schedule of currently awarded SSNs to meet an unexpected military situation, this could not be accomplished under current capacity conditions without drastic and costly shifts in production schedules for Tridents and nuclear surface ships.

(U) An active additional facility with excess construction capacity could meet such surge requirements. For example, either Puget Sound or Mare Island could produce as many as two SSNs per year with relatively minor additions in physical facilities and each has room for expansion to three or more submarines per year.

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4. Increase Competition (Control Prices) (U)

a. Recent Navy/Business Relationships (U)-- Newport News and Electric Boat are owned by two large conglomerates, Tenneco and General Dynamics, respectively. Both conglomerates have enormous business assets and have other operations which are as large or larger than their shipbuilding divisions. The latter are likely to be regarded merely as profit centers and/or cash flow generators and must compete with other divisions for corporate resources. The result of this conglomerate situation is that whenever a contract change is made or a contract dispute occurs the Navy finds that it must deal with the conglomerate corporate entity rather than the specific shipyard. Although the shipyard officials themselves might be anxious to settle any difficulties, the corporate offices may be relatively indifferent and willing to draw out a dispute, or even reject Navy business if it would appear to be in long-term corporate interest.

(U) The foregoing is the actual situation the Navy has had to face. Contract disputes have occurred at both Electric Boat and Newport News. Both conglomerates have used the full power of their legal organizations to settle the disputes and have used all the standard legal tactics (court delays, excessive claims, threats to close down operations, etc.). Of course, the Navy itself has been demanding in its objective to produce high quality, safe nuclear ships at reasonable cost and with due regard for the health and safety of shipyard workers and the surrounding communities. The conglomerates response to this has been to argue that the Navy insistence on ever higher standards and unanticipated technical problems have increased costs and that the Navy ought to pay the additional costs.

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b. The "Increase Competition" Argument (U)--An argument put forth by the Navy is that a continuous nuclear shipbuilding program (e.g. 1 SSN-688 per year) in government yards would increase the competition faced by the two conglomerates; i.e., they would be less certain of their markets. Presumably, this would make them more conciliatory with respect to contract disputes and more anxious to minimize additional change order cost claims. In addition, as indicated earlier, the government shipyard construction program would provide cost benchmarks which could be used in settling change order cost claims as well as for subsequent pricing of follow-on ships or new classes of ships. Whether these benefits in fact would accrue cannot be proven by assertion.

C. AVAILABILITY OF NUCLEAR FACILITIES AND PROCESSES (U)

(U) If it becomes necessary or desirable to construct nuclear ships in shipyards other than the Electric Boat or Newport News, one argument for reinstituting construction in one or more of the three government yards is the fact that they already have nuclear facilities and trained personnel who are used to working under the exacting quality and safety control processes associated with nuclear shipwork.

1. Difficulty of Developing Experience (U)

(U) Although a private shipyard may have had prior experience with nuclear shipwork, it takes a great deal of management time and effort merely to prepare for the employee training programs that nuclear quality control, safety, and security processes require. In addition, the employee training programs per se must be carefully developed and administered. Further, the quality control processes (e.g.,

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for welding thick high-strength steel) require careful and voluminous documentation procedures as well as efficient information retrieval systems.

2. Minimizing Nuclear Shipbuilding Sites (U)

(U) In discussing the minimizing of "nuclear" installations it is important to distinguish between the activities of building new nuclear ships and overhauling and repairing nuclear ships--the hazards involved are quite different. In new building, the fueling of the nuclear reactor and its activation are among the last steps in construction, so that during most of the construction activity there is no nuclear hazard, and the hazard is only the (thus far) slight one involved in the presence of any fueled nuclear reactor. Much of the same applies to overhaul and repair of nuclear-powered ships. The most hazardous phase of such work is the refueling of the reactor, which takes place at most two times in the thirty-year active life of a major warship. The removal and disposal of spent fuel and contaminated parts is a procedure carried out under the most rigid and exacting safety precautions, but the materials involved are extremely radioactive and toxic. Since it is only prudent to assume that a shipbuilding facility designed to build nuclear ships might eventually be used to repair nuclear ships, the remarks below should be understood in that context.

(U) There are three major objections to increasing the number of nuclear shipbuilding sites. First, because of concern and publicity about public and environmental safety considerations, there is public resistance to adding nuclear installations of any kind, especially near major population centers. This includes not only the "popular" groups which organize demonstrations and institute law suits, but

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government agencies as well. In spite of safety assurances from the Navy and DOE, new installations are carefully scrutinized by local, state and other federal government agencies, and the review process can take several years. Moreover, the length of the review period cannot be predicted accurately, so that the uncertainty as to when ships could be delivered from a proposed new site is increased.

(U) Second, there is in fact an increased accident risk especially if shipyard management and personnel are inexperienced in handling nuclear work. This applies to workers' health and safety as well as external public and environmental safety.

(U) Third, security management problems are increased with respect to physical security of materials, equipment, and defense information as well as the task of obtaining personnel security clearances.

(U) All of the above problems would be mitigated, if not eliminated, if any additional required nuclear ship production were handled by government shipyards. These yards already have nuclear facilities, personnel trained in handling nuclear ship-work, and the management and organizational structure to monitor nuclear safety and security. Of course, the same would be true if Electric Boat or Newport News could undertake the additional production at their present sites.

3. Non-Nuclear Private Shipyards Not Interested in Nuclear Work (U)

(U) There are strong reasons why other private shipyards would not be interested in bidding for additional nuclear ship requirements. First, the probable number and dollar volume of ship awards over and above Electric Boat and Newport News' probable share appears not to be large enough to assure

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adequate profits in relation to required investments. This is especially true under current interest rate conditions.

(U) Second, and this is related to the first reason, there are simply too many regulations and problems associated with starting up a nuclear ship construction facility to warrant the investment under current profit requirements.

(U) Third, the quality control, safety and security requirements associated with nuclear ship construction, especially submarines, are necessarily stringent. It is very difficult to forecast profit levels under these conditions.

(U) These considerations do not apply to the two currently qualified private yards. Newport News regards repair and overhaul as desirable work and has specially designed facilities for major overhaul of submarines, including refueling. General Dynamics would use its Quincy facility to undertake submarine overhaul, if Navy approval could be gained. In addition, senior Navy officials regard nuclear overhaul and repair as a desirable "work-leveler" for these two private nuclear building yards.¹

(U) On the basis of the recent lack of expressed interest by suppliers other than Electric Boat and Newport News, one can doubt that additional private nuclear ship construction and/or repair capacity would be offered if bids were solicited. However, the ultimate test of private industry action would have to be an offer of a contract. Profit-seeking firms are not accustomed to responding with firm assurances to hypothetical offers of business.

¹(U) This is the opposite of the "flywheel effect" in government shipyards.

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D. INTRINSIC BENEFITS AND ACTIVE CONSTRUCTION (U)

1. Active Versus Stand-by Capability (U)

(U) If it is conceded that all these benefits would flow from the Navy's possessing a capability to construct ships, a possible position is that current arrangements provide such a capability and that no major change in policy or action is required. Whether or not the current situation represents a real near-term capability can be determined finally only by directing one or more yards to institute production and observing what happens. The studies performed by the Navy suggest that major investment is needed now if the yards assigned the production mission are to produce ships at competitive costs and without long building times. This, however, argues only that obtaining a reliable stand-by capability requires major investment and personnel policy decisions now. But there are some benefits that are more likely to be realized with an active construction program. Others may be had by quite separate means.

2. Maintenance of Construction and Production Engineering Skills (U)

(U) Maintaining competence in building ships without actual construction experience does not seem possible. Some tasks involved in overhaul and repair may be similar to those in construction, but if currency in shipbuilding technology and management of complex shipbuilding projects is to be required of government shipyards, then new construction awards must be given to them.

3. Ship Design and Development (U)

(U) The fact that independent marine architectural and engineering firms exist would indicate that competence in ship

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design does not require that the designer be an employee of a new-construction shipbuilding firm. It is thus theoretically possible for the government to develop a design capability without its own building activity. As a monopsonist buyer of warships from U.S. industry, it could impose its designs on industry. The exact means by which a design capability could be maintained, e.g. government institutes, laboratories, scholarship programs, interns, is beyond the scope of this study.

4. Improved Estimates of Shipbuilding Costs (U)

(U) There is little doubt that a full understanding of shipbuilding costs needed in contract negotiations is impossible to obtain without access to the accounting detail of an actual shipbuilding operation. Actual construction in a government yard would provide such information providing the technology was similar and accounting system cross-walks could be performed. Whether such information would provide for government savings in contracting that would offset the costs of obtaining it--including higher costs of government ship construction--is debatable.

5. Production and Price Assurance (U)

(U) The benefits of reducing capacity uncertainties, reducing delivery uncertainties, and increasing competition that would flow from ship construction in government yards would also come about if new private shipbuilders could be induced to enter the nuclear shipbuilding industry. Thus these arguments are not very strong ones unless it is certain that no reasonable inducements could expand the private shipbuilding base. The benefit of a surge capability, however, is more likely to be realized from government

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shipbuilding. This is a result of the lesser ability of private firms to tolerate excess capacity. Thus a naval shipyard, which is not subject to profit and loss considerations, might indefinitely sustain a production program at less than capacity--one definition of surge capability--while a private firm could not.

6. Availability of Nuclear Facilities (U)

(U) The fact that additional nuclear building capacity can be obtained in government shipyards without increasing the number of nuclear sites is a generalized community benefit which could be obtained in private industry only at the two nuclear-qualified private yards. If the desired output could be achieved at those private yards, the question of proliferation would not necessarily arise and the claimed benefit would be moot.

E. HOMEPORTING AND OVERHAULS (U)

(U) One non-financial advantage claimed for Navy proposals to resume SSN construction at a naval shipyard is that it partially solves the out-of-homeport overhaul problem on the East Coast by putting Electric Boat back into active overhaul of submarines.

(U) The problem of ensuring that nuclear ship overhauls take place in or near the home port of the ship in question, so that relocation of families and/or separation of families is avoided, can be solved by means other than directing new construction to U.S. Navy shipyards. The heart of the problem seems to be that of the absence of any nuclear-qualified repair yard in the vicinity of the New London Submarine Base. The U.S. Navy approach that would place SSN building awards at Electric Boat-Groton with assignments to overhaul

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New London based submarines--and then assign the SSN building to a west coast Navy yard--seems an unnecessarily indirect way to solve the basing/overhaul geography problems.¹ Expanding the labor force at Portsmouth Naval Shipyard to accommodate New London overhaul would seem a much more cost/effective approach. The alternative suggested by General Dynamics, repair of SSNs at its Quincy yard (some 60 miles closer to New London), has consistently been rejected by the Navy on several grounds which include "management dilution," the poor material condition of the yard, and nuclear proliferation.

(U) In any case, it is hard to resist the conclusion that the Navy has not fully investigated its alternatives in dealing with the problem of homeport and overhaul geography. The choice of reinstituting construction activities cannot be made to depend heavily on a problem that is a complex of past history, past and current strategy, bureaucratic rules and the domestic politics of base location. It is not beyond the bounds of possibility that a newly constructed U.S. Navy submarine overhaul yard would be a desirable solution to the homeport problem. The U.S. Navy has closed yards that were relevant only to past fleets and past strategies. It has built at least one new base for the new era, the Bangor, Washington, Trident base. Perhaps it is time to dispel the notion that the only direction in which military base investment can go is downward.

¹(U)This is an admittedly worst case view of current NAVSEA analyses.

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Chapter V

STUDY CONCLUSIONS, DECISION ALTERNATIVES, AND RECOMMENDATIONS (U)

A. STUDY CONCLUSIONS (U)

(U) The factors to be considered in deciding the future role of government shipyards in building and maintaining the nation's nuclear-powered warship fleet can be grouped under four headings. They are:

1. (U) Nuclear construction, overhaul and repair capacities of private and government shipyards.
2. (U) Relative construction costs in private and government shipyards.
3. (U) Special or "intrinsic" benefits of constructing ships in government shipyards.
4. (U) Qualification of a shipyard for construction of nuclear-powered ships or for their repair and overhaul.

These factors have been discussed in detail in preceding chapters of this report. The major findings are summarized in the following sections. We should note here that the discussion below considers only completely government-owned or privately owned shipbuilding facilities. Not considered are a whole complex of mixed arrangements. Annex B discusses some of the implications of "GOCO" alternatives.

1. Construction, Overhaul and Repair Capacities (U)

a. Construction Capacities (U)

- (1) (U) Physical facilities adequate to construct all the nuclear ships in the PDM-83/EPA program

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exist at Newport News and Electric Boat. On this measure of capacity, no need exists for construction of such ships in government yards.

- (2) (U) On the basis of implied employment expansion, planned production at Newport News appears to exceed the labor capacity of the yard.
- (3) (U) The problem of Newport News is partly due to its nuclear overhaul and repair load, but primarily a result of the coincidence of the high CVN and CGN building rates in the plan.
- (4) (U) Various alternatives to solve the overload problem at Newport News could be worked out. Among them are
 - (a) (U) Assigning the CGNs to a third yard, such as Puget Sound Naval Shipyard
 - (b) (U) Stretching out the planned CGN procurement,
 - (c) (U) Reassigning nuclear submarine overhaul and SSN construction to government shipyards,
 - (d) (U) Depending upon increased productivity in the CVN and SSN building programs to alleviate the problem.
- (5) (U) The output sufficiency of Electric Boat and Newport News depends in part upon whether Electric Boat attains output rates as claimed by its management or reverts to the lower productivity of 1977-80 as is forecast by some Navy sources. In the former case Newport News is the critical yard, as described above. In the latter case, a third source for SSNs will be required.

b. Overhaul and Repair Capacities (U)

- (1) (U) The Navy expects nuclear surface ship and submarine overhaul and repair loads to peak in the 1985-1988 time frame and continue to be heavy after 1988.
- (2) (U) Taken as a group, the government shipyards have the physical capacity to meet the future nuclear ship overhaul and repair requirements.
- (3) (U) Taken as a group, the government shipyards can handle the future nuclear overhaul and repair requirements if

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- (a) (U) manpower ceilings are raised in selected shipyards,
 - (b) (U) some additional non-nuclear surface ship overhaul and repair projects are shifted to private shipyards, and
 - (c) (U) additional facilities are installed in certain shipyards.
- (4) (U) The current inability of Atlantic Coast government and private shipyards to overhaul all nuclear submarines homeported on the East Coast outside of their homeport area will be remedied, to a degree, if the measures in (a) and (c) above are taken at Portsmouth.
- (5) (U) Proposals to resume overhaul of New London-based submarines at Electric Boat's Groton yard will solve the home-port problem, but at the cost of reducing EB SSN output by at least one SSN per year, thus requiring a third source for SSN construction.
- (6) (U) The projected expansion of nuclear overhaul and repair workload at Newport News could eventuate in employment demands exceeding the yard's growth capacity if the projected CVN construction and overhaul, SSN construction and CGN-42 construction and CGN-38 conversion projects in the middle and late 1980s are assigned. This could generate a requirement for either a third source for SSNs, a second source for CGN-42 or CGN-38 work, or a second source for CVN construction--whether or not (5) above took place.

2. Relative Ship Construction Costs (U)

(U) No government shipyard has been awarded a nuclear ship contract in over ten years. For this reason, one can only look at past performance and at the current level of factors that would affect cost. Our findings are:

- a. (U) Because of regional differences in wage rates, West Coast private and government shipyards are automatically at a disadvantage with respect to East Coast shipyards. For example, a journeyman mechanic in a private West Coast shipyard receives about 41

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percent more than a journeyman mechanic in an East Coast yard.

- b. (U) It does not seem to us that either Mare Island or Puget Sound could produce SSN-688-class submarines using fewer mandays than Electric Boat or Newport News. Therefore, it can be assumed that the relative labor costs would be at least as high as the relative wage rates. The range of relative wage rates is 19 percent higher for Puget Sound to 35 percent higher for Mare Island.
- c. (U) Assuming that all three government yards could achieve the same productivity levels in producing SSN-688s, Portsmouth has the potential of being the lowest cost government shipyard because of lower wage rates.
- d. (U) Puget Sound has a record of having the low overhaul and repair manday dollar rates relative to other government shipyards. This is in spite of the regional differences in wage rates and indicates consistently higher labor productivity. However, direct comparisons among government shipyards are not possible due to differences in overhaul and repair projects. For example, Mare Island and Portsmouth specialize in nuclear submarine overhaul and repair which requires greater labor intensity than the predominantly surface ship overhaul and repair performed at Puget Sound.
- e. (U) The extensive new construction facilities at Puget Sound and the shipyard's record of high productivity indicate that the shipyard could compete with Newport News, productivity-wise, in building nuclear cruisers. Any cost difference would be the result of regional wage differences.

3. Intrinsic Benefits (U)

(U) The fact that the entire privately owned capacity to build nuclear ships is in the hands of two divisions of two major industrial conglomerates is a source of anxiety to the Navy and DoD with respect to the delivery of nuclear warships and a source of frustration to the Navy and DoD in negotiating contracts. Electric Boat, as a division of General Dynamics, is the sole source for Trident submarines. Newport News is

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the sole source for nuclear aircraft carriers and for nuclear cruisers. Between them they supply all the nuclear attack submarines. Newport News is, at the moment, a valued subsidiary of TENNECO,¹ but threats to discontinue Navy work at Newport News were made by TENNECO during the contract disputes of the 1970s. That risk is undoubtedly higher when a shipbuilder is a part of a conglomerate which must concern itself with relative rates of return across its divisions.

(U) In any case, private nuclear construction capacity beyond that of Electric Boat and Newport News does not exist; nor is there any apparent incentive for it to come into existence. Short of a major expansion in the nuclear portion of the fleet--e.g. a doubling of the number of nuclear submarines to be built in the next fifteen years--we would not expect an existing shipbuilder to seek nuclear qualification and, even less, a new firm to enter the field.²

(U) Thus, the "production assurance" argument for at least maintaining a government shipyard construction capability has merit on the grounds that the nuclear qualification already exists at government yards and there is little private sector interest in re-entry or new entry.

(U) With respect to nuclear shipbuilding capacity, then, the appropriate rule for government shipyards turns on whether or not a surge capability for rapid expansion of the nuclear

¹(U)"Energy Growth Fuels Problem for a Conglomerate" Business Week, November 23, 1981, pp. 80-87; "Ketelson [TENNECO Chairman] says Newport could well be one of the most profitable TENNECO divisions of the 1980s, rivaling oil and gas." p. 86.

²(U)Our only evidence of this is a recent Navy solicitation of interest in nuclear repair qualification that drew only one positive response--an unsolicited proposal to qualify for new construction by a builder of auxiliaries and Coast Guard ships.

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fleet is desired as a matter of policy. As long as the shipbuilding mission continues to be a contingent responsibility of naval shipyards, then we can infer that these establishments are considered to constitute such a reserve of capacity. Whether they in fact constitute a reserve that would be effective if called upon to respond rapidly is the central question of the debate over assigning active new combat shipbuilding projects to one or more government-owned yards. In terms of the intrinsic benefits discussed earlier, the question is whether or not they can be realized by shipyards engaged in repair activities only, but not in new construction. We do not have the expertise to resolve such questions in this study. However, we can offer some comments that may be of use in narrowing the debate.

(U) First, we would like to consider the argument that because of the long building times involved in nuclear warships, any shipbuilding project undertaken after the start of an emergency would not be completed until well after it were over, even in the case of a major war. Therefore, it is argued, the reserve shipbuilding capacity of the government yards is irrelevant to any serious purpose. While one can argue that considerable reduction in building times could be had under wartime mobilization conditions, start of construction to delivery times would still, we think, be measured in years. Therefore the justification for such reserve capacity must be in terms of the capability to consider alternate plans for expansion of nuclear ships over a period of years--and force potential enemies to recognize that such potential expansions are a realistic possibility to be considered in their strategy.

(U) What this means is that strategic flexibility requires a shipbuilding reserve that can be used in a stop and

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go fashion. Private industry, by its nature, cannot be expected to support such idle capacity except via a direct subsidy program of some sort. We have not looked at such an alternative in this study--the non-proliferation of nuclear sites argument would be heavily weighted in such a decision, however.

(U) Thus, if the government wishes to consider strategies that involve substantial variations in the rate of output of nuclear ships, the government shipyards would seem to offer the most immediate source of surge capacity, if not the best source. The question then becomes whether or not some level of active new combatant ship construction is required to make this reserve capacity responsive and efficient. We are simply unable to answer this complex question. It is true that the minimally necessary skills and facilities for building a nuclear ship by conventional methods exist at most government shipyards which are currently overhauling such ships. If ordered, these yards could build a ship, but perhaps in a length of time and at a cost that would compare unfavorably with private industry. Modernizing facilities to master private builder technology would help, but again many Navy authorities argue that without actual experience in building and even in design, efficiency will be low.

(U) As a last comment, we think it should be recognized that if the government shipyards became the "shock absorber" in a strategy that requires wide variations over time in the building rate of nuclear ships, then their efficiency can never approach that of an approximately level-loaded private shipbuilder. The decision for or against shipbuilding in government yards, we think, should never be allowed to turn solely on questions of relative cost. In fact, any realistic

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program might depend more on co-operation between government and private builders than on competition.¹

B. DECISION ALTERNATIVES (U)

(U) The following general alternatives for the choice required by the Vinson-Trammell Act in FY 1983 were identified:

1. Do not reinstitute new building in any government yard in FY 1983, but retain the shipbuilding mission (U), either
 - (a) (U) with no action except possible manpower ceiling increases, or
 - (b) (U) with major modernization of repair facilities at one or more yards.

Discussion: (U) The consequences of choosing 1.(a) are that the Navy accept the current contract situation for new nuclear ships and a continued decline in its own stand-by capability to build ships. Given present (PDM-83) nuclear shipbuilding plans, no production schedule problem is likely before 1987 or later. Currently estimated two year lead times for a government yard to actually begin active building might become longer.

If 1.(b) were chosen and a ship lift and transfer system installed at one or more government yards, repair and overhaul capability would be improved² and such a facility could be used to assemble nuclear submarines

¹(U)See Annex B, below, for some possibilities of government-private arrangements.

²(U)Current Navy practice prohibits the lift of ships with fully fueled reactors on the grounds that flooding of a malfunctioning system is not possible as in a below-grade drydock. Some naval officers interviewed believed this policy might change in future.

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from modules supplied by Newport News or Electric Boat. With these facilities in place, the response to a new building go-ahead thus could be reduced to months. An investment of \$89 million or more in Military Construction appropriations (MILCON) would be required in 1983-84.

2. Assign one or more FY 1983 (or later) awards to a government yard (U). The yard could either

- (a) (U) serve as a third source of SSN-688-class submarines, with the modernization of facilities to match that of Electric Boat and Newport News building technology desirable, or
- (b) (U) serve as design yard for the CGN-42-class cruiser and build the lead ship.

Discussion: (U) Choice of the 2.(a) alternative would require the Navy to develop some sort of subcontractor or customer relationship with Electric Boat and/or Newport News. Unless additional submarines over these Navy-planned submarines were ordered, the result might be unused delivery capacity at Electric Boat, Groton or its return to overhaul and repair work. Besides the investment in MILCON as in 1.(b) above, higher construction costs for government built submarines would be likely.

(U) The 2.(b) alternative could be accomplished currently only at Puget Naval Shipyard. No major facilities modernization would be required. Diversion of facilities and manpower from repair and overhaul of nuclear surface ships would affect Pacific fleet readiness adversely until additional large-hull facilities were built on the West Coast.

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3. Discontinue the new construction mission for government yards (U), while

- (a) (U) initiating development of additional private nuclear building capacity at currently qualified or to-be-qualified private yards, and
- (b) (U) taking action to increase nuclear overhaul and repair capacity at government yards by increased manpower and/or modernized facilities.

Discussion: (U) This option might require repeal of the operative Vinson-Trammell Act clauses. The development of additional private capacity would be needed only if the CGN-42 program were absolutely fixed in numbers and schedule or if a "warm" nuclear shipbuilding reserve base were desired. In either of these cases, the short-run effect might be to push additional nuclear overhauls into government shipyards.

C. RECOMMENDATIONS (U)

(U) Whether or not the findings in this study point to a decision to resume new construction in government shipyards will depend upon the weighting of the various factors outlined above. The findings appear to support the following recommended actions, but there could be overriding considerations leading in other directions.

1. Sole Sources for CVNs and Tridents (U)

(U) The Government should concede that Newport News and Electric Boat are in fact the sole source suppliers of the CVNs and Tridents, respectively, and proceed to remove any uncertainties with respect to future (authorized) orders.¹

¹(U) This does not mean that the Government should give up its prerogative of discontinuing orders if the shipyards' costs are prohibitive or if the yards' performance is unsatisfactory.

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(U) This will help the shipyards to:

- a. (U) Maintain critical manpower levels,
- b. (U) Plan manpower acquisitions,
- c. (U) Plan and acquire materials and equipment, and, therefore
- d. (U) Improve production methods.

(U) Both shipyards have the potential for increasing productivity through prefabricating and prepackaging large modules and/or cylinders. This requires a high degree of advanced planning and acquisition of materials and equipment. Uncertainties as to whether or not the planned series of ships will actually be procured can seriously disrupt the process and, therefore, reduce productivity and increase costs.

2. SSN Programs (U)

(U) The government should recognize the fact that the combined capacity of Electric Boat (Groton and Quonset Point) and Newport News is adequate to meet the projected requirements for nuclear attack submarines. The PDM-83/EPA Trident and CVN programs, respectively, will not fully utilize the shipyards' productive capacities. The government should

- a. (U) Design a nuclear attack submarine procurement program that will take full advantage of the productive capacities of the two shipyards.
- b. (U) Recognize that such a decision would help stabilize manpower and materials acquisition at the two yards.

(U) The implementation of Recommendations 1 and 2 would settle the government's procurement policies with respect to its most certain and highest priority nuclear ship construction programs. To assure success of these programs, it is essential that business relations between the government

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and the two suppliers be such that they do not inhibit efficient ship construction. The assurance of a stable order book (subject, of course, to adequate supplier performance) would be a step in that direction. Given these stable market conditions, the suppliers would have an opportunity to substantiate their claims that the ships can be produced on schedule and with successively increasing efficiency.

(U) We recognize that the government has had difficulties with both Electric Boat and Newport News in recent years. However, the shipyards have made efforts to change the prevailing conditions. Electric Boat's Quonset Point Facility has met its commitments and will soon be under-utilized. Newport News made available its massive prefabrication facility and 1,600 foot graving dock for exclusive Navy ship construction and has made substantial additional improvements. These developments would appear to reduce the level of risk to the government in continuing to depend on the two suppliers.

3. CGN-42 Program (U)

(U) If the CGN-42 program is assured of funding through at least the lead ship, consideration should be given to constructing that lead ship at Puget Sound. Follow ships can be divided between Puget Sound and Newport News. The latter might be considered only if the shipyard is performing satisfactorily with respect to its CVN and SSN-688 assignments.

(U) If Recommendations 1 and 2 are implemented, Newport News will have responsibility of producing the CVNs and some of the attack submarines. Although the shipyard would have adequate physical facilities, there is some doubt as to whether it could develop the labor force to handle the entire CGN program.

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(U) Puget Sound already has adequate construction-oriented facilities to build the CGNs. In addition, there are substantive benefits to reinforcing and maintaining a ship design, R&D, and construction capability within the Navy. Moreover, the shipyard has a demonstrated record of high productivity in previous shipbuilding efforts.

(U) However, a careful study should be made as to Puget Sound's future nuclear surface ship overhaul and repair workload, particularly for CVNs. If the CGN construction program would interfere with the overhaul and repair workload, the responsibility for CGN design and production might better be shifted to Newport News or to a third private company; however no other yard is currently licensed to undertake nuclear construction.¹

4. Naval Shipyards Repair and Overhaul Program (U)

(U) The Navy should study how its performance of more nuclear surface and submarine repair at its own shipyards could be reorganized and modernized to provide a quick-response conversion to construction if needed. The Navy would need additional resources to perform this work, i.e.,

- a. (U) Shipyard manpower ceilings should be raised where and when necessary,
- b. (U) Facilities improvement should be made where necessary,
- c. (U) Major reassignments of nuclear and non-nuclear work among government and private shipyards might be needed.

¹(U)Opinions differ as to the difficulty of obtaining such license. Officials at one currently licensed private yard indicated that about two years and \$100 million investment would be required.

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(U) The balancing of work loads among shipyards could create a crew and family morale problem with respect to homeport assignments and could affect crew retention rates. However, the impact on homeport assignments may be minimized if items (a), (b) and (c) are implemented in East Coast shipyards, because it is the East Coast- based nuclear submarines that cannot now be overhauled in East Coast commercial or Navy shipyards.

(U) We also recognize that Congressional action is required in order to implement this recommendation.

5. Industrial Base Reserve (U)

(U) Whatever the other choices, in order to provide for a contingent quick response construction capability, the Navy should undertake to construct ship lift and transfer systems at selected Navy shipyards such as Puget Sound, Mare Island and Portsmouth and perhaps eventually at all yards. Such systems should be designed to be compatible with the level building pre-assembly techniques at Electric Boat and Newport News. In the event of production interruption at assembly sites of Electric Boat and Newport News (or other builders for that matter), or if a surge in production were needed, the public yards could proceed to assemble and fit out hulls from modules obtained from the same sources as Electric Boat and Newport News.

(U) The full costs of implementing this and the previous recommendation have not been determined in this study.

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¹(U) No classified material from the text of the classified paper referenced is being used in this unclassified paper.

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Annex A

TASK ORDER (U)

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12 June 1981

TASK ORDER

NO. MDA903 79 C 0018: T-1-112

TITLE: The Reinstitution of the Construction of US Navy
Combatant Ships in US Government Owned Shipyards

1. This task order is for work to be performed by the Institute for Defense Analyses (IDA) for the Under Secretary of Defense for Research and Engineering.

2. BACKGROUND:

The "alternative vessel" provision of the Vinson-Trammell Act of March 27, 1934, (48 Stat 503) as reenacted by Section 302 of Public Law 89-37 requires that the first and each succeeding alternate warship be constructed in naval shipyards. It also provides that the President may vary this pattern in any year in the public interest.

The last new construction ship project assigned to a Navy yard was in fiscal year 1966. The last ship construction at a Navy yard was completed in 1977. The principal reasons usually cited for not resuming new construction in US Government owned and operational naval shipyards are:

- (1) additional costs of ships built in public yards;
- (2) the adequacy of the production base in the private yards, and
- (3) the provision of OMB circular A-76 which restricts the growth of Government owned, Government operated industrial facilities.

3. OBJECTIVE:

To provide the Secretary of Defense with sufficient information on which to base his recommendation to the President as to the construction of US Navy vessels in Government yards as required by the Vinson-Trammell Act. This decision will be required at the time of the submission of the fiscal year 1983 budget.

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4. ADDITIONAL GUIDANCE:

An in-depth analysis is to be conducted of the relative costs and intrinsic benefits to be derived if the President were to direct that some of the programmed ships shall be constructed in the Government Navy yards. Use should be made of past studies that have a bearing on the subject conducted by IDA, Booz Allen and the Naval Sea Systems Command. The Navy currently has an in-house effort underway to assess the cost of building nuclear submarines at the US Naval Shipyard, Mare Island.

Since the tentative fiscal year 1983 Program Objective Memorandum has long lead funds for a nuclear cruiser in the Navy shipbuilding plan and proposes additional nuclear aircraft carriers in subsequent years, this study should not be limited to considering nuclear submarines construction. Recent statements by the Secretary of the Navy indicate a goal of a 600 ship force level, defined as 600 deployable ships. Therefore, it can be assumed that we are really contemplating a ship force level similar to the 700+ ships as recently analyzed in IDA Report No. 260, "Shipbuilding Industries of the US and the USSR as Bases for National Maritime Policies: Current Capabilities and Surge Demand Potential," Volumes I and II.

5. SCHEDULE:

A draft (final) report is required by January 15, 1982, with the final report published within two weeks after completion of review by OUSDRE. Interim informal progress briefings will be held in the last weeks of each month and on a need basis.

6. FUNDING:

The total cost of this task will be \$150,000; \$50,000 is authorized in FY 81 and \$100,000 is planned for FY 82.

7. TECHNICAL COGNIZANCE:

This study is sponsored by USDRE. Technical cognizance for the task is assigned to OUSDRE/Naval Warfare. (Mr. John McGough is the OUSDRE action officer).

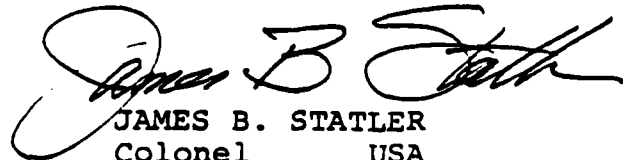
8. SPECIFIC ADMINISTRATIVE INSTRUCTIONS:

a. If, at any time during the course of this task, IDA identifies the need for changes in this task, such as additional resources, schedule modification, changes to emphasis of effort or scope, etc., as set forth in the above paragraphs, a report, with appropriate recommendations, will be submitted in accordance with the terms of the IDA/WSEG Memorandum of Understanding of 12 March 1975 (and its successor) as applicable to the Executive Secretary, DOD-IDA Management Office, OUSDRE, with a copy to the sponsor or his project officer, as appropriate. Changes in this task will be made only with the approval of appropriate cognizant DoD officials.

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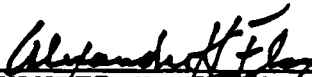
b. This task will be conducted under Industrial Security Procedures in the IDA area. If certain portions of the task require the use of sensitive information which must be controlled under military security, the DOD-IDA Management Office will provide supervised working areas in which work will be performed under military security control.

c. A "need to know" is hereby established in connection with this task and access to classified documents and publications and security clearances necessary to complete the task will be obtained through the DOD-IDA Management Office unless otherwise instructed. Report distribution and control will be determined by the sponsor.



JAMES B. STATLER
Colonel USA
Executive Secretary
DOD-IDA Management Office

ACCEPTED


ALEXANDER H. PEAX
President, Institute for Defense Analyses

DATE June 16, 1981

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ANNEX B

ALTERNATIVE SHIPBUILDING ORGANIZATIONAL AND MANAGEMENT
STRUCTURES (U)

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ANNEX B (U)

ALTERNATIVE SHIPBUILDING ORGANIZATIONAL AND MANAGEMENT STRUCTURES¹(U)

(U) Since 1972, all naval ships have been constructed in contractor-owned-contractor-operated (COCO) shipyards. Prior to the end of 1972, naval ships were also constructed in government-owned-government-operated (GOGO) shipyards. Thus the typical organizational and management structure has been either one or both of these two forms.

(U) In effect, this report examined the current feasibility of re-instituting government-owned-government-operated yards for nuclear ship construction and has recommended no active construction at present. This implies that nuclear submarines and surface ships should continue to be constructed in contractor-owned and operated yards. However, there are alternatives to these two organizational/management structures, two of which are explored in this Annex. These are:

- A. (U) Government shipyards for final assembly and outfitting (GSFAO)
- B. (U) Government-owned-contractor-operated (GOCO) facilities.

The discussion is confined to production of nuclear attack submarines.

¹(U) This annex draws heavily upon the analysis and discussion provided by NAVSEA and the U.S. Naval Shipyards at Puget, Portsmouth and Mare Island. The conclusions, however, are the authors' responsibility.

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A. GOVERNMENT SHIPYARDS FOR FINAL ASSEMBLY AND OUTFITTING (U)

1. General Description (U)

(U) This organizational structure is implicit in proposal by naval shipyards to construct ship lift and transfer systems at their yards and purchase pre-outfitted cylinders from Electric Boat-Quonset facility. The general procedure would be.

- a. (U) One or more of the government shipyards would be equipped with ship lift and transfer and land-level facilities similar to those at Electric Boat-Groton.
- b. (U) In addition to propulsion systems, weapon systems and other major equipment and components, the government would purchase partially-outfitted cylinders from Electric Boat-Quonset or any other contractor with a similar cylinder production technology.
- c. (U) The cylinders and other equipment would be assembled and outfitted at the government shipyard. Presumably the end-loading outfitting techniques developed at Electric-Boat-Groton would be adopted.
- d. (U) The assembly and outfitting would be performed by government employees committed to the construction project; i.e. the shipyard's overhaul and repair work would be a separate operation.

2. Requirements for Success of System (U)

(U) For this system to succeed at least the following conditions must be present:

- a. (U) The government shipyard must have an assembly and outfitting technology which is compatible with that of the private sector. This implies a high degree of coordination and cooperation between the government yard and its suppliers, especially with respect to sharing construction technology research and development.
- b. (U) The ships must be designed and engineered for the construction technology. This implies that the government would need a strong construction design and

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engineering staff. Ship design changes must be minimized.

- c. (U) The government shipyard would need a strong planning procurement, and scheduling staff for the construction activity as well as for its overhaul and repair activity. Otherwise, serious production delays could occur.
- d. (U) The government shipyard would need unlimited purchasing authority. In addition, government procurement practices would have to be revised, where necessary, to accommodate to the stringent production schedules associated with assembly operations of this nature.

3. Positive Factors (U)

(U) The following are the main factors in favor of the GSFAO system:

- a. (U) No additional nuclear shipbuilding sites would be necessary. Government shipyards would maintain control over the nuclear aspects of the construction process.
- b. (U) Government shipyards would be actively engaged in nuclear shipbuilding and would be operating with the latest ship construction technology. As a result, the information bases for construction processes would be improved, especially with respect to:
 - (1) (U) Manpower requirements for all phases of construction
 - (2) (U) Equipment and material costs
 - (3) (U) Quality assurance and control procedures
 - (4) (U) Ship construction technology
 - (5) (U) Designing ships to utilize the construction technology.
- c. (U) The surge capability for nuclear submarines would be active, especially if more than one government shipyard were to install compatible ship lift and transfer and land level facilities.
- d. (U) A large proportion of the construction activity would still be performed in the private sector.

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Moreover, this proportion could be varied by increasing or decreasing the degree of cylinder outfitting at the cylinder manufacturing plant.

4. Negative Factors (U)

(U) The following are the main arguments against adoption such as system:

- a. (U) If the government shipyard is on the Pacific Coast, labor costs for the government portion of the construction process will be higher than for construction on the Atlantic Coast. However, this difference can be reduced by heavy pre-outfitting of the cylinders.
- b. (U) The military construction costs would be 89-234 million dollars (see Chapter 3). Personnel ceilings at the selected government yard(s) would have to be raised by the amount of the required new construction labor force.
- c. (U) The two current private sector nuclear shipbuilders might not be willing to cooperate in such an arrangement. The existence of government construction activity could add to their uncertainty with respect to future naval shipbuilding markets. Much would depend upon the degree of participation of these two suppliers as well as the size of the attack submarine program. If the program size were such that the two suppliers could build the entire program, there would be little incentive to cooperate in a joint construction program with a government yard.
- d. (U) Although the cylinders would be manufactured and partially outfitted at the private contractor facility, a high degree of Navy participation at that site might be necessary for quality assurance and control as well as schedule adherence. Clearly, an adversary relationship must not exist under such circumstances. Only experience can demonstrate whether or not the necessary close Navy/contractor production cooperation can be developed, but there are many conflicting interests that would have to be compromised to gain such an atmosphere. Much would depend on the original willingness of the contractor to enter into the arrangement. This would depend primarily on how his profit incentives were taken care of in the scheme.

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- e. (U) Much would depend also upon the government's reasons for engaging in such an activity. If the reason were primarily to provide a competitive threat to keep the two private yards in line with respect to costs, claims, schedule adherence, etc., the process would probably fail. However, if there is a genuine need to expand nuclear submarine production, and this cannot be handled by the two private companies because they are too heavily engaged in other Navy construction programs, the two yards should be willing to participate.

B. GOVERNMENT-OWNED-CONTRACTOR-OPERATED SHIPYARDS (U)

1. General Description (U)

(U) While there are many possible GOCO operations, they can be characterized under three general types:

- a. (U) The contractor has full use of the government-owned facility. The private company supplies the management and personnel to perform all activities associated with constructing the ship. The facility is used as though it were owned by the company. The price charged by the contractor excludes capital facilities costs, but includes everything else.
- b. (U) The conditions are the same as a. above except that the contractor performs only specified activities. For example, the material and equipment procurement activity may be performed by the government. The contractor would then recover only for the labor and management cost of constructing the ship, plus a fee.
- c. (U) The government provides all of the resources. The contractor supplies the management and certain key personnel essential to the construction process. The contractor charges a management fee for the services rendered. Contractor actions would be subject to the approval of the government in considerable detail.

(U) The choice of the GOCO system to be used depends upon the degree of control over the contractor desired by the government and the specific conditions at the government facility. Case a. above involves the least degree of

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government control over the contractor; case c. provides the greatest.¹

(U) In the past, GOCO systems for building nuclear submarines have been proposed as a last resort action to counter private sector threats to stop work on Navy shipbuilding contracts, as well as a means of dealing with unsatisfactory performance on the contracts. Under these conditions the government would buy out the facilities of essential shipyards and hire a new contractor to operate the plant under a case c. type of arrangement. According to proponents, the specific purpose of such a takeover would be to assure that the ships would be according to specification, on time, and within budget limits. The procedure would eliminate contract disputes, because the government would be running the contract.

(U)"...If the contractor failed to perform well, the Government would have the right to replace him with another contractor to operate the facility... [The procedure] would guarantee the Navy access to the facilities and put an end to the claims business [i.e. the contract disputes]..."²

2. Positive Factors (U)

(U) On the other hand, GOCO shipyards may be feasible under more positive conditions. In particular, if the government were to decide to build nuclear submarines by the

¹(U) Presumably, it is the latter arrangement that Admiral Rickover had in mind in his testimony before the Joint Economic Committee. (See "Economics of Defense Procurement Claims," Hearings Before the Subcommittee on Priorities and Economy in the Government of the Joint Economic Committee, Congress of the United States, 95th Congress, 2nd Session, Part 3, p. 287, et seq.)

²(U) Ibid., p. 321.

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process described in Section A, the government might consider hiring a qualified contractor to manage the assembly and outfitting process, e.g., the same contractor that would provide the cylinders. This would complete the rationalization of the cylinder production and government shipyard facilities. Moreover, it would provide the close cooperation between the private and government sectors that is essential to a successful operation.

(U) Some additional advantages of this procedure are:

- a. (U) It provides greater assurance that the management of the ship construction activity in the government shipyard is kept separate from the vital overhaul and repair activity.
- b. (U) U.S. nuclear shipbuilding facilities are more efficiently utilized and the number of nuclear construction sites is minimized.
- c. (U) The private sector has a higher degree of participation in construction process. A greater degree of coordination between the cylinder manufacturing and assembly/outfitting process would probably be achieved.
- d. (U) All of the benefits of the GSFAO process described in Section A would be obtainable, because the government would have closer surveillance of the contractor's activities.
- e. (U) The shipbuilding contracts would be administered by the government; therefore, contract disputes would be minimized. The government would have control over its own facilities and could replace the contractor if necessary. There would be no need to acquire the contractor's facilities.

3. Negative Factors (U)

(U) The negative factors presented in the previous section would generally apply here, also. Private sector participation in such a scheme would depend upon perceived

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future market conditions and profits, and whether or not the governments motives are positive or negative. If a clear cut shortage in private sector nuclear submarine capacity were to emerge, the two existing private contractors would not consider a GOCO shipyard operation as a threat to their existence, especially if they were given the opportunity to manufacture the cylinders using remote facilities, as well as to participate in the assembly and outfitting process.

4. Final Remarks (U)

(U) Two aspects appear to be essential to the success of the use of government shipyards as final assemblers and outfitters of nuclear attack submarines. First, there must be a clear-cut shortage of construction capacity in the private sector. This is important in order to provide credibility with respect to the government's intentions about construction in government shipyards. Second, the construction technology at the government yards must be compatible with that at the private sector yards; i.e., the government must be willing to construct ship lift and transfer and land level facilities that will handle the cylinders. Otherwise, most of the benefits of construction at government shipyards would be lost, and construction costs would be too high.

(U) A GOCO (case c) operation for management of the assembly and outfitting activities at the government shipyards appears to be desirable, if not essential. This procedure would increase the probability that the private cylinder manufacturing technology and government shipyard activities would be rationalized successfully and would provide a greater incentive for private sector participation.

END

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